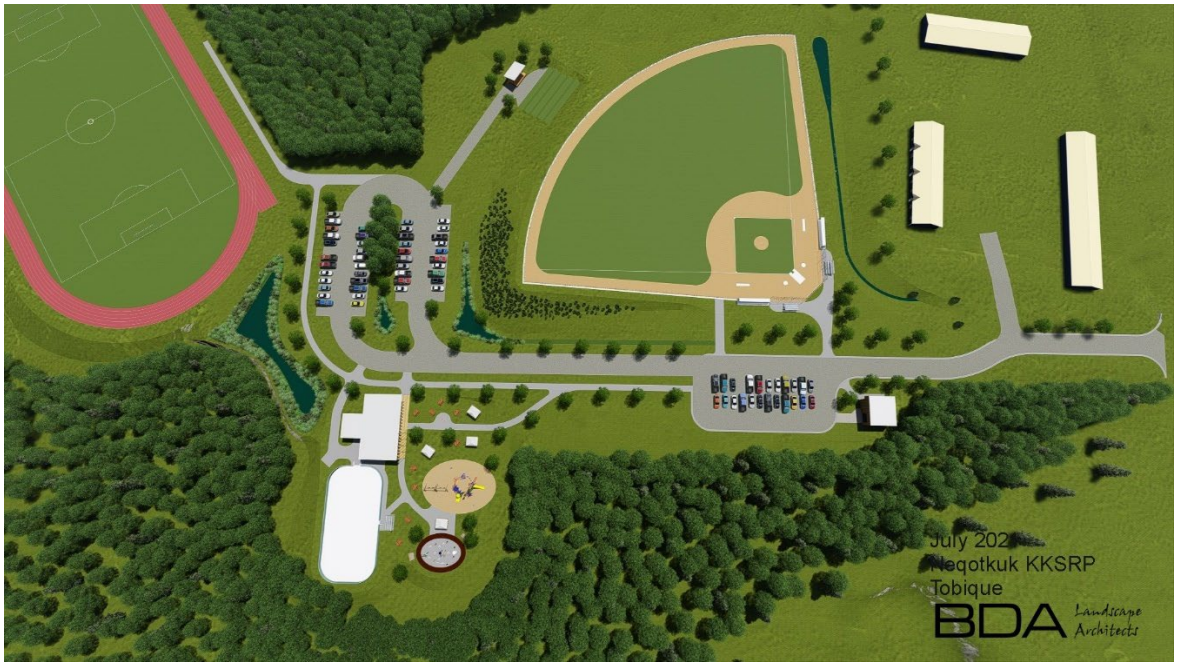
TOBIQUE FIRST NATION



TECHNICAL SPECIFICATIONS

NEQOTKUK KCIW KNICANEWEK SPORTS AND RECREATION PARK – PHASE 2 BUILDINGS

EVOQ project no: 9223-18-00

ISSUED FOR TENDER

2022-06-03

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 30 00 – Administrative Requirements.

.2 Section 03 11 19 – Insulating Concrete Forming.

.3 Section 03 20 00 – Concrete Reinforcing.

.4 Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.

.3 CSA S269.1-1975(R2003), Falsework for Construction Purposes.

.4 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.

.2 Submit shop drawings for formwork and falsework.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of new Brunswick, Canada, in accordance with the New Brunswick Occupational Health and Safety Act.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 30 00 – Administrative Requirements.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequence of erection and removal of formwork/falsework.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86 and CSA-A23.1/A23.2.

.2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.

.3 For Service and Park Center Building foundation walls, use insulating concrete forming.

.2 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.3 Form release agent: non-toxic, biodegradable, chemically active release agent containing compounds that react with free lime in concrete resulting in water insoluble soaps.

.4 Falsework materials: to CSA-S269.1.

.5 Sealant: to Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.3 Fabricate and erect falsework in accordance with CSA S269.1.

.4 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.5 Do not place shores and mud sills on frozen ground.

.6 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.8 Align form joints and make watertight.

.1 Keep form joints to minimum.

.9 Use 25 mm chamfer strips on external corners where indicated on drawings.

.10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.11 Construct forms for architectural concrete, and place ties and/or as directed.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.12 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 1 day for footings.

.2 2 days for walls and piers.

.3 Under no circumstances will removal of formwork be accepted until criteria at item 2 is satisfied.

.2 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1. SUMMARY

.1 Section Includes:

.1 Comply with the requirements for Division 1.

.2 Furnish all labor, materials, tools and equipment to perform the complete erection/ installation of the Insulating Concrete Form System (ICF), installation of reinforcing steel, placement of concrete within formwork, and final cleanup.

.3 Adequate bracing and false work shall be provided by the Installing Contractor to comply with all applicable Codes.

.2 Products Supplied But Not Installed Under This Section:

1. EPS compatible parge coat.

.3 Products Installed But Not Supplied Under This Section:

1. Sleeves
2. Inserts
3. Anchors
4. Bolts
5. Reinforcing Steel
6. Concrete

.4 Related Requirements:

1. Section 03 20 00- Concrete Reinforcing
2. Section 03 30 00- Cast-In-Place Concrete

1.2. PRICE AND PAYMENT PROCEDURES

1. Alternates:

.1 Materials shall be only as specified in Paragraphs 2.02 & 2.03 as per Manufacturer specified in Paragraph 2.01. No alternate materials shall be accepted for this Section.

1.3. REFERENCES

.1 Abbreviations and Acronyms:

.1 EPS- Acronym for “Expanded Polystyrene” when referencing the insulating foam component of the Insulating Concrete Form System.

.2 ICF- Acronym for “Insulating (or Insulated) Concrete Form”

.2 Definitions:

.1 Form Alignment System- a form alignment & scaffold system designed exclusively for use with Insulating Concrete Forms.

.2 Trained Installer- An installation contractor, who has received instructional training in the installation of the specified Insulating Concrete Form System and is capable of providing written verification of his designation as such by the specified manufacturer of the system being installed.

.3 Technical Associate- A technical representative, usually a staff member of a Distribution Firm, who has received instructional training in the installation of Insulating Concrete Form system and is in the capacity of supervising an installation crew on site.

.4 Window or Door Opening Buck- a pre-manufactured or site constructed frame assembly consisting of wood or plastic material (or combination thereof) used to frame a rough opening within the forming system that will retain concrete around the opening. The frame can also provide for subsequent anchorage of doors and windows within the wall assembly.

.3 Reference Standards:

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulations

.2 ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

.3 ASTM C203: Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation

.4 ASTM C272: Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions

.5 ASTM C303: Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation

.6 ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.7 ASTM D1621: Standard Test Method for Compressive Properties Of Rigid Cellular Plastics

.8 ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging

.9 ASTM D2863: Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

.10 ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.11 ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials

.12 ASTM E336: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.

.2 Canada Construction Materials Centre (CCMC)
  .1 Technical Guide for the Evaluation of Modular Expanded-Polystyrene Concrete Forms.

.3 Canadian Standards Association (CSA)
  .1 CAN/CSA A23.3 Design of Concrete Structures

.4 Underwriters Laboratories of Canada Inc. (ULC)
  .1 CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials
  .2 CAN/ULC S102: Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  .3 CAN4-S124-M: Test for the Evaluation of Protective Coverings for Foam Plastic
  .4 CAN/ULC S-134: Fire Testing of Exterior Wall Assemblies
  .5 CAN/ULC S701: Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering
  .6 CAN/ULC S717.1: Standard for Flat Wall Insulating Concrete Form (ICF) Systems

1.4. ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

  .1 Ensure those materials listed under Sub-Sections 2.01 though 2.03 are provided to Trained Installer prior to commencement of work under this Section.
  .2 Trained Installer for this section shall provide list of known special requirements for interface of materials provided in this section as such may pertain to co-ordination with mechanical, electrical, plumbing, interior and exterior finish sub trades prior to commencement of work.

1.5. SUBMITTALS

.1 Bid Submission Documents:

  .1 Contractor shall submit with bid proposal for this section written confirmation of:
    .1 Name of ICF Product forming the basis for the material cost of the bid.
    .2 Name of ICF Product forming the basis for the labor cost of the bid.
      If two different ICF products are involved in above, contractor shall specify BOTH material AND Labor bids associated with each material.
  .2 Contractor shall submit with bid proposal for this section, written verification of credentials of the subcontractor responsible for the form system installation (*trained installer*) designated to be installing the ICF product as follows:
    .1 That the installing contractor is either:
      1) An experienced ICF Contractor (*trained installer*) with minimum 3 years experience in commercial ICF construction or;

2) A qualified masonry or traditional concrete forming contractor with minimum 5 years experience in commercial construction applications.

.2 Test and Evaluation Reports:

.1 *Technical Associate* for form system shall submit on request, relevant laboratory tests or data that validate product compliance with performance criteria specified prior to commencement of work under this Section (See Section 2.03 B Regulatory Requirements).

.2 Submit copy of valid product evaluation report demonstrating compliance with this specification and applicable codes for site condition. (See Section 2.03 B Regulatory Requirements).

.3 Manufacturers' Instructions:

.1 Submit copy of manufacturer's product installation manual

.4 Form Alignment System Engineering:

.1 For wall heights above 3.6 meters (12 ft) of unsupported wall height, the contractor shall provide scaffold engineering for support of the *Form Alignment System* or shall ensure this engineering is included by the engineer of record for support of the form system and the *Form Alignment System* assemblies during construction.

1.6. CLOSEOUT SUBMITTALS

.1 Warranty Documentation:

.1 Product warranty documentation specified under Section 1.11 shall be supplied to contractor (for subsequent provision to building owner) upon completion of building construction.

1.7. MAINTENANCE MATERIAL SUBMITTALS

.1 Maintenance:

.1 *Trained Installer* shall supply to contractor (for subsequent provision to building owner) copy of pertinent documentation as relates to instruction on post repair, renovation, modification or service work with respect to the form system once occupancy commences.

1.8. QUALITY ASSURANCE

.1 Qualification- Installers / Applicators / Erectors:

.1 Contractor shall engage the services of a *Trained Installer* or *Technical Associate* for the duration of the work under this Section who has been trained in procedures pertaining to the correct installation of the specified form system (*Trained installer* may already be the designated ICF Installing Contractor if providing credentials as such).

.2 *Trained Installer/Technical Associate* shall furnish proof of training documentation to Contractor prior to commencement of work under this Section.

.2 Mock-ups:

.1 If required, construct sample wall mock-up panel to include full wall system and details, located where directed by Consultant. Panel may form part of finished work if approved by Consultant.

1.9. DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements:

.*1* *Trained Installer/Technical Associate* to meet with Contractor prior to material delivery on site to co-ordinate provision of access, storage area, and protection of insulating concrete form product and spatial requirements for *Form Alignment System* placement steel storage & forming.

.*2* Deliver products in original factory packaging, bearing identification of product, manufacturer and batch/lot number.

.3 *Trained Installer* shall furnish product packaging labels to contractor as required to maintain traceability of product for duration of contract.

.4 Bulk of form shipment shall be delivered as pre-assembled units and folded flat to maximize shipping space. Only form panels and insert webs as may be required for floor interfaces or specialized construction on site are to be shipped unassembled but in labeled packages for traceability

.2 Storage and Handling Requirements:

.1 Handle and store products in location to prevent damaging and soiling.

.2 Maintain form materials and accessories in original packaging (or provide similar protection to unpackaged form materials -should on-site storage prior to installation extend beyond 3 months).

.3 Form units and related form installation materials and equipment to be stored flat until time of use.

1.10. SITE CONDITIONS

.1 Ambient Conditions:

.1 Use appropriate measures for protection and supplementary heating when required to ensure proper curing conditions in accordance with manufacturer’s recommendations if installation is carried out during periods of weather where temperatures are below minimum specified by governing Building Code for concrete and masonry.

1.11. WARRANTY

.1 Manufacturer Warranty:

.1 *Technical Associate* shall supply of written copy of specific warranties of the product.

Part 2 Materials

2.1 MANUFACTURERS

.1 Manufacturer List:

.1 Provide insulating concrete form system materials from one of the following Manufacturers assuring that system selected complies in all respects with performance requirements of Section 2.03.

.1 Nudura Corporation (www. Nudura.com);
.2 Logix ICF;
.3 or approved equal.

.2 Substitution Limitations:

.1 Forming System shall carry an active listing/classification for fire resistance rating of the completed wall assembly as endorsed by Underwriters Laboratories® of Canada Inc. (ULC) per testing to the ANSI/UL-263 Standard.

.2 Form System supplied shall provide full height webs fastening strips in contact throughout height of the wall assembly at 203 mm (8”) o/c placement within system to assure minimum settlement during concrete placement and maximum sleeve insertion diameter possible between webs.

.3 Form system shall provide dovetail flutes to both sides of its interior cavity to enable structural bonding of concrete to foam once concrete is cured.

2.2 INSULATING CONCRETE FORMING SYSTEM (ICF)

.1 Where project scope permits, form units shall be supplied through an authorized distributor of the Manufacturer listed for the bid. The distributor shall be capable of providing product on site within 24 hours notice.

.2 The Manufacturer’s authorized distributor shall have available local to the region, technical sales staff that can be contacted or even contracted (under separate contract) as may be required to provide timely on site problem resolution as installation or product supply issues may arise.

.3 Where local distribution cannot service the requirements of the contract scope and product is to be supplied directly by the manufacturer, the manufacturer shall provide on-site technical assistance as specified under Clause 4 of this section.

.4 Where product is supplied direct, technical assistance supplied by the manufacturer shall include the provision of a technical consultant direct from or contracted by the manufacturer for first week of contract that form product is to be erected on the site to coordinate form system installation, crew organization and set-up. During installation, (as agreed to with terms of contractor), the manufacturer’s technical consultant shall provide periodic site visits

(as may required under separate contract) at key stages of form installation, to assure continued product installation quality.

2.3 DESCRIPTION

.1 General:

.1 Insulating concrete form system shall consist of two (2) flame resistant panels of expanded polystyrene (*EPS*) connected by either high-density polypropylene hinged pin foldable webs or EPS embedded polystyrene fastening strips interconnected with slide in format - high density polypropylene web connectors. EPS foam panels shall feature continuous vertical dove tail grooves on interior panel surfaces to provide integral surface bonding to concrete core once filled and concrete is cured. Dove tail grooves shall also facilitate structural linkage with end cap forms placed into the form cavity where required as part of the overall architectural design layout.

.2 All web fastening strips to run full height of form and be fitted top and bottom with reversible fitting, “triple-tooth” interlocking mechanisms to enable positive vertical interlocking of forms with each other. Wall system webs to provide minimum 38 mm (1 ½”) wide fastening strips at 203 mm (8”) on center approx 15.9 mm (5/8”) below insulation face to facilitate finish fastening of both interior and exterior finishes.

.3 Insulating concrete form system shall be capable of forming ALL of following concrete core thicknesses: 102, 152, 203, 254 or 305 mm (4, 6, 8, 10 or 12-inches) wall sections (as required for various locations throughout project scope with standard form line-up) (See form dimensions summary Attachments Table A at end of Section.

.4 Insulating concrete form system shall provide a minimum insulation panel thickness of 66.7 mm (2 5/8”) throughout ALL forms and panels forming the form system product inventory (with exception of variance required for brick ledge and tapered top forms).

.5 All form units of wall forming system shall be capable of being shipped to site in folded condition to minimize shipping cost and site storage space requirement and be capable of being deployed to installation ready condition by simply unfolding the unit in a single pull motion or pull motion combined with insertion of a single web (at corner condition).

.6 Standards, corner forms and stand alone panels of form system shall provide fully reversible interlocks along top and bottom edges to assure minimum product waste on site. EPS foam panels shall be molded with 25 mm (1”) wide by 12.7 mm (½”) high/deep alternating male/female reversible projection/socket interlocks positioned in pairs along both top and bottom edges of all panels.

.7 Wall system shall be capable of providing horizontal and vertical lock positioning of steel within form cavity to conform to all reinforcing requirements of CAN/CSA A23.3.

.2 Regulatory Requirements:

.1 Form system manufacturer shall provide on request, written documentation verifying active compliance to the Canadian Construction Materials Centre’s “Technical Guide for the Evaluation of Modular Expanded-Polystyrene Concrete Forms”, with valid listing in the report verifying qualification of form system for use

in Types I through V construction as qualified under the governing Building Code for this project and additional compliances as outlined in Section 2.03.1.2.3 (below).

.2 Documentation as provided per Section 2.03.1.2.1 shall verify that form system has been assessed and confirmed in conformance with:

.1 Form system structural, and general performance assessment of properties of EPS foam and polypropylene materials assessment in accordance with the following standards:

.1 CAN/ULC S701: Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering (Which Includes Results for);

.1 ASTM C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulation
.2 ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
.3 ASTM C203: Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
.4 ASTM C272: Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
.5 ASTM C303: Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
.6 ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
.7 ASTM D1621: Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
.8 ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
.9 ASTM D2863: Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
.10 ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials

.3 As required by Architect- additional documentation to be supplied by manufacturer on request to include (dependent upon construction classification) one, part, or all of the following tests or documentation;

.1 Finish attachment testing in accordance with:
.1 ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood (Modified for Polypropylene Web assessment) (Need to do something here but could not understand the note)

.2 Surface Burning, Flash Ignition and Self Ignition Temperature Characteristics assessment of both plastic web and EPS form materials in accordance with:
.1 ASTM D635: Standard Test Method for Rate of Burning and/or Extent and of Burning of Plastics in a Horizontal Position

.2 CAN/ULC S102: Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
.3 ASTM D1929: Standard Test Method for Determining Ignition Temperature of Plastics

.3 Verification of performance and compliance of finishes for provision thermal barrier protection to foam plastic.
.1 CAN4-S124-M: "Test for the Evaluation of Protective Coverings for Foam Plastic" proving that the finish material attains a minimum classification "B" as specified in this standard for…
.2 CAN/ULC S101: "Standard Methods of Fire Endurance Tests of Building Construction and Materials" with observation conducted by the testing authority specific to finish facing the immediate fire face of the test assembly proving compliance a classification "B" as described under CAN4-S124-M "Test for the Evaluation and Protective Coverings for Foam Plastic"

.4 Fire Resistance Rated Construction assessment in accordance with:
.1 CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials" (See also Sections 2.01 and 2.04.1. 4 through 9)

.5 Non-Combustible Construction assessment substantiating compliance with one of the following:
.1 Testing to verify stay-in-place burn duration of 15 minutes without perforation or failure or the exterior finish coating when tested in application over the specified form product in accordance with "CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials" or;
.2 Engineered listing as provided by a 3rd party Standard Council of Canada (SCC) accredited independent testing agency verifying a stay-in-place burn during of 15 minutes without perforation or failure of the exterior finish coating when applied over a sheet form plastic insulation that is of greater than or equivalent combustible content than the specified for product's exterior foam surface when tested in compliance with "CAN/ULC S-134: Fire Testing of Exterior Wall Assemblies".

.6 Additional Testing and engineering documentation to verify qualification of EPS foam panels as a Vapor Retarder in conjunction with testing to:
.1 ASTM E-96 Standard Test Methods for Water Vapor Transmission of Materials

.7 Testing and engineering documentation to verify qualification of fully assembled wall system as an air barrier element in accordance with:
.1 ASTM E1677 Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls

.8 Testing and engineering documentation to verify qualification of the form system as meets the minimum STC performance requirements of 50 (and STC 55 for application around garbage chutes and elevators) in accordance with:

.1 ASTM E 90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements, or;

.2 ASTM E 336: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.

.4 Sustainability Characteristics:

.1 When required by Architect/Engineer, *Technical Associate* for the form system shall provide, written documentation verifying product recycle content and manufacturing location compliances with respect to CaGBC/LEED® document submissions.

2.4 PERFORMANCE / DESIGN CRITERIA

.1 Capacities:

.1 Selected system in conjunction with concrete and designated exterior and interior finishes shall provide minimum insulation level of R 23.59 (hr.ft^2.F/Btu) or (RSI 4.158 (m^2.K/W) -U Factor 0.2405 W/m2.K) across full line of form unit cavity widths.

.2 *EPS* foam panels forming part of wall system shall provide maximum vapor permeation rate of 36 ng/Pa.s.m^2 (0.78 Perm-inch) based on 66.7 mm (2 5/8") singles thickness of foam on interior surface of concrete core.

.3 Finished wall assembly formed by system shall provide minimum sound transmission class (STC) sound attenuation performance as follows:

.1 100 mm (4") core form (if specified):

.1 STC 42 (when installed with 12.7 mm (½") gypsum board both sides)

(Not to be used for demising walls unless specified otherwise by architect)

.2 STC 52 (when installed as specified by manufacturer with additional hat channel and acoustic material with 15.9 mm (5/8") finish on one side (12.7 mm (½") gypsum board opp.).

.2 6-inch (152mm) core form

.1 STC 50 (with regular 12.7 mm (½")gypsum board both sides)

.4 Finished insulating concrete form wall assembly shall be capable of providing fire resistance ratings as listed in this section. Manufacturer of the specified wall assembly number (BXUVC.WO12) shall be actively listed and classified with Underwriters Laboratories of Canada Inc. Listings shall be verifiable under Certifications Directory of ULC at:

http://database.ul.com/cgi-bin/XYV/template/LISCANADA/1FRAME/index.html

.5 Fire resistance ratings shall be established by testing in full accordance with CAN/ULC S-101 when installed as per the listed classification (BXUVC.WO12)
  .1 100 mm (4") core form - 2 hour fire resistance rating
  .2 152 mm (6") core form and above - 4 hour fire resistance rating

.6 Per BXUVC.WO12 Note 2- Wall reinforcement shall consist of minimum grade 400 metric bar (No. 4) 60 ksi yield strength installed at 400 mm (16") o/c vertically and 457mm (18") o/c horizontally.

.7 Per BXUVC.WO12 Note 3- Concrete shall be minimum 20 MPa (2900psi) compressive strength at 28 days and shall be a minimum density of 2,323 kg/m^3 +/- 80 kg/m^3 (145 lbs +/- 5lbs /ft^3) using regular siliceous concrete aggregate.

.8 Per BXUVC.WO12 Note 4- Finished wall assembly shall provide above noted fire resistance ratings using unclassified or classified 12.7 mm (½") gypsum board finish (interior surface only for exterior walls and both sides for interior demising walls).

.9 When reinforced per BXUVC.WO12 Note 2, 152 mm (6") load bearing wall must demonstrate being able to be loaded to a minimum axially applied load of 5,532 kg/m (40,000 lbs/lf) for full 4-hour burn duration under above test conditions.

2.5 MATERIALS

.1 Insulating Concrete Forming:
  .1 Provide Insulating Concrete Forming as listed in Appendix A as may be required for proper execution of the work.

.2 Concrete:
  .1 Concrete supplied under Section 03 30 00 shall be of strength as specified by the design engineer (measured at 28 days). Recommended maximum aggregate size to be 12.7mm (½") aggregate for 102mm & 152mm (4" & 6") cavity forms and, 19mm (¾") aggregate for 203mm (8") cavity forms and higher.
  .2 Recommended concrete slump is 102mm to 152mm +/- 25mm (4" to 6" +/- 1") (subject to design revision to suit application).
  .3 Where required by engineer of record, recommended slump specification shall be attained through addition of super plasticizer/mid-range water reducing agents to achieve design mix strength and concrete flow-ability.

.3 Reinforcing Steel:
  .1 Reinforcing steel shall be as specified in Section 03 10 00 and shall be supplied under that Section for placement by the Form System's *Trained Installer*.

.4 Waterproofing:
  .1 Where specified, waterproofing shall be self-adhesive modified bituminous sheet waterproofing membrane as supplied by concrete form system manufacturer specific to the form system specified under this section. Material to be supplied under this Section & installed as specified under Section 07 13 52 (Modified Bituminous Sheet Waterproofing).
  .2 Waterproofing material shall be *EPS* foam compatible.

.5 Parging:

.1 Where called for on drawings, parging (acrylic stucco type) shall be as recommended and supplied by Concrete Form Manufacturer under this section and installed as specified under Section 09 24 00 (Portland Cement Plaster).

.2 Alternate EIFS supplied and installed under Section 07 24 00 (Exterior Insulation and Finish System).

2.6 ACCESSORIES

.1 *Form Alignment System*

.1 The *Trained Installer* shall furnish and utilize the Wall Access and *Form Alignment System* (as supplied by the Manufacturer or approved equivalent) to facilitate construction of the wall assembly, and to provide adjustment for ensuring plumbness and straightness of the wall system during construction, just prior to concrete placement and immediately after concrete placement while form system is still adjustable to final finished position.

.2 *Form Alignment System* shall be CSA Standards and OPS Specification compliant. *Technical Associate* shall supply engineering documentation pertaining to the "base" *Form Alignment System* components to verify compliance upon request.

.3 As specified under Section 1.05 Submittals, for wall heights above 3.6 m (12ft), the contractor shall provide scaffold engineering for *Form Alignment System* support or shall ensure this engineering is included by the engineer of record for support of the form system during construction.

Part 3 Execution

3.1. INSTALLERS

.1 Installer List:

.1

.2 Substitution Limitations:

.1 Per Section 1.05 Submittals – Bid Submittal requirements, the installing contractor for this section shall be:

.1 An experienced ICF Contractor (*trained installer*) with minimum 3 years experience in commercial ICF construction or;

.2 A qualified mason or traditional concrete forming contractor with minimum 5 years experience in commercial construction applications.

.3 A qualified master carpenter with minimum 5 years experience in commercial construction applications.

3.2. EXAMINATION

.1 Verification of Conditions:

.1 Inspect all areas included in Part 1 Section 1.01 Summary to establish extent of work and verify site access conditions.
.2 Verify that site conditions are as set out in Part 1- Section 1.10 Site Conditions.

.2 Evaluation and Assessment:
.1 Examine footings installed under Section 03 10 00 are within +/-6 mm (¼") of level and that steps footing increments are 457 mm (18") in height.
.2 Where partial or half course is intended for starting course elevation, ensure step footing increment is equal to cut form unit less 13 mm (½").
.3 When specified, ensure reinforcing steel dowels are in place at specified centers along footing lengths.
.4 Ensure reinforcement steel dowels have CSA Standard compliant protection installed until formwork is erected above dowel level.

3.3. PREPARATION

.1 Surface Preparation:
.1 Clean all debris from top of footings prior to commencement of insulating concrete form system installation.
.2 Sequence installation of concrete formwork with related work specified in other sections to ensure that wall assemblies, including window and door accessories, trim, service penetrations, transition changes, and mechanical service are protected against damage from effects of weather, corrosion, and adjacent construction activity.

3.4. ERECTION / INSTALLATION / APPLICATION

.1 Installation Procedures:
.1 Installation of forms to be in strict accordance with manufacturer's product installation manual as supplied in evidence to contractor under Part 1 Section 1.05 of this Section.
.2 The *trained installer* shall ensure all manufacturer's procedures for the following work are employed on site (as outlined in the manufacturer's product Installation manual) Additional to all required procedures being followed, the trained Installer shall specifically assure cross checks with respect to layout, leveling and vertical alignment are executed as noted below in each section:
.1 First Course Placement – perform cross checks for accuracy of plan layout to survey pins, marks or grid lines as set by the contractor.
.2 Horizontal Reinforcement Placement – assure reinforcement diameter, grade and positioning is accurate to engineering specifications on structural drawings and installed in correct axis of wall for each course placed.
.3 Successive Course Placement – assure system is accurately leveled subsequent to 2nd course placement.
.4 Door & Window Opening Construction – when specified, assure bucks have been prepared for anchorage with concrete and/or fitted with mesh attachments as may be required for subsequent exterior finishes such as acrylic stuccos or similar architectural coatings for non-combustible

construction. *Trained Installer* shall also assure all top, bottom and stirrup steel fittings are installed per engineering specifications.

.5 *Form Alignment System* /Installation – assure *Form Alignment System* is regularly checked for crew safety, anchorage to form system as specified, vertical alignment checks at both pre-placement of concrete as well.

.6 Vertical Reinforcement Placement- assure reinforcement diameter, grade and positioning is accurate to engineering specifications on structural drawings and installed in correct axis of wall, prior to placement of concrete.

.7 Pre-Concrete Placement Inspection- trained installer shall assure string lines are place at top of all pours and wall system aligned for placement, cross check and assure that all required service penetration sleeves, embed plates, anchor bolts, fittings, beam pocket preparations, as specified on drawings are in place prior to commencement of concrete placement.

.8 Concrete Placement- trained installer shall assure concrete tickets retained for contractor records and that slump, strength and aggregate size are as specified per Section 2.04 of this Section. *Trained installer* to assure truck delivery timed for rate of placement and that placement does rate not exceed ACI recommended practices. *Trained installer* shall also assure that concrete during lift placement is mechanically and internally vibrated per ACI Standards to assure full monolithic concrete placement for all areas of formwork.

.9 *Form Alignment System* and Scaffold Access Assembly, adjustment & removal. *Trained installer* shall assure entire wall lengths aligned to vertical plumb by string line and screeded to horizontal level as required for finished wall height prior to concrete set. Subsequent to initial concrete cure, contractor shall assure that scaffold access and *Form Alignment System* remains in place until removal is directed accordingly by engineer of record for the project.

.2 Interface with Other Work:

.1 Service penetrations (electrical service conduits, water service pipes, air supply and exhaust ducts etc.) shall be installed at the required locations as indicated by the appropriate trade.

.2 Service penetrations exceeding 400 mm x 400 mm (16” x 16”) in area shall be reinforced per engineer specifications

.3 Prior to concrete placement, install service penetration sleeves (supplied by others) at designated locations to create voids for service placement at later date.

.4 Instructions for exterior finish application to be reviewed with each trade. Contractor shall contact *Trained Installer* for specific instructions where sub trade has insufficient information or specialty requirements not addressed in specification specific to ICF applications.

3.5. CLEANING

.1 Waste Management

.1 Clean up and properly dispose of all debris remaining on job site related to the installation of the insulated concrete forms.

3.6. PROTECTION

.1 Assure final finishes are installed over form product or provide temporary coverage of installation to reduce EPS foam surface exposure to ultra violet light should final finish application be delayed longer than 18 months after form product installation.

.2 Consult with exterior finish contractor concerning exposure to ultraviolet light to ensure proper finish to ICF walls.

ATTACHMENTS

(A) SUMMARY OF SPECIFICED FORM UNIT THICKNESSSES AND DIMENSIONS

Product	Feature	4" (100mm)		6" (150mm)		8" (200mm)		10" (250mm)		12" (300mm)	
		inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
Standard Form Unit	Length	96	2438	96	2438	96	2438	96	2438	96	2438
	Width	9 1/4	235	11 1/4	286	13 1/4	337	15 1/4	387	17 1/4	438
	Height	18	457	18	457	18	457	18	457	18	457
	EPS Thickness	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67
90 Degree Form Unit	Length (a) (lng)	31 5/8	803	31 5/8	803	33 5/8	854	35 5/8	905	37 5/8	956
	Length (b) (sht)	15 5/8	397	15 5/8	397	17 5/8	448	19 5/8	498	21 5/8	549
	Width	9 1/4	235	11 1/4	286	13 1/4	337	15 1/4	387	17 1/4	438
	Height	18	457	18	457	18	455	18	455	18	455
45 Degree Form Unit	Length (a) (lng)	26 1/2	673	26 1/2	673	26 1/2	673	28 1/2	724	30 1/2	775
	Length (b) (sht)	10 1/2	267	10 1/2	267	10 1/2	267	12 1/2	318	14 1/2	368
	Width	9 1/4	235	11 1/4	286	13 1/4	337	15 1/4	387	17 1/4	438
	Height	18	457	18	457	18	457	18	457	18	457
	Length	48	1219	48	1219	48	1219	48	1219	48	1219

One & Two Sided Tapered Top Form Units*	**Width**	9 1/4	235	11 1/4	286	13 1/4	337	15 1/4	387	17 1/4	438
	Height	18	457	18	457	18	457	18	457	18	457
	EPS Thickness	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67
Molded Brick Ledge*	**Length**	48	1219	48	1219	48	1219	48	1219	48	1219
	Width	9 1/4	235	11 1/4	286	13 1/4	337	15 1/4	387	17 1/4	438
	Height	18	457	18	457	18	457	18	457	18	457
T-Form Units (main and T- wall core thickness matching)	**Lg. T Mn. Lgth**	18	457	20	508	22	559	24	610	26	660
	Sh. T Mn. Lgth	50	1270	52	1321	54	1372	56	1422	58	1473
	Height	18	457	18	457	18	457	18	457	18	457
	EPS Thickness	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67
Molded Brick Ledge & Tapered Top Unit	**Length**	48	1219	48	1219	48	1219	48	1219	48	1219
	Width	9 1/4	235	11 1/4	286	13 1/4	337	15 1/4	387	17 1/4	438
	Height	18	457	18	457	18	457	18	457	18	457
Brick Ledge Extension	**Length**	32	813	32	813	32	813	32	813	32	813
	Width	4 1/2	114	4 1/2	114	4 1/2	114	4 1/2	114	4 1/2	114
	Height	13 1/2	343	13 1/2	343	13 1/2	343	13 1/2	343	13 1/2	343
End Cap	**Width**	4 1/4	108	6 1/4	159	8 1/4	210	10 1/4	260	12 1/4	311
	Height	18	457	18	457	18	457	18	457	18	457
	EPS Thickness	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67	2 5/8	67
	Fast. Strip Op.	YES		YES		YES		YES		YES	
Height Adjuster	**Length**	32	813	32	813	32	813	32	813	32	813
	Height	3	76	3	76	3	76	3	76	3	76
	Fast. Strip Op.	YES		YES		YES		YES		YES	

These form units sold in 2438 mm (96-inch) lengths in some regions of the USA

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 30 00 – Administrative Requirements.

.2 Section 03 10 00 – Concrete Forming and Accessories.

.3 Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

.1 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A143/A143M-03, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A185/A185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A497/A497M-05a, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

.4 ASTM A775/A775M-04a, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A23.3-04, Design of Concrete Structures.

.3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

.3 Submit drawings, stamped and signed by professional engineer licensed in Province of New Brunswick, Canada.

.4 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

.5 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings and locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.6 Detail lap lengths and bar development lengths to CSA-A23.3, but not less than:

.1 400 mm for 10M.

.2 600 mm for 15M.

.3 700 mm for 20M.

.4 1100 mm for 25M.

.7 Quality Assurance: as described in PART 2 – SOURCE QUALITY CONTROL.

.1 Upon request, submit in writing to Engineer proposed source of reinforcement material to be supplied.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Engineer.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

.3 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.

.4 Deformed steel wire for concrete reinforcement: to ASTM A497/A497M.

.5 Welded steel wire fabric: to ASTM A185/A185M.

.1 Provide in flat sheets only.

.6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.7 Plain round bars (where applicable): to CSA-G40.20/G40.21-300W.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain Engineer's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, inform Engineer of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Engineer.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Use plain round bars as slip dowels in concrete.

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 When paint is dry, apply thick even film of mineral lubricating grease.

.3 Prior to placing concrete, obtain Engineer's approval of reinforcing material and placement.

.4 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 30 00 – Administrative Requirements

.2 Section 03 10 00 – Concrete Forming and Accessories.

.3 Section 03 20 00 – Concrete Reinforcing.

.4 Section 13 17 60 – Ice Rink Slab

.5 Section 31 23 33.01 – Excavating, Trenching and Backfilling

.6 Section 32 16 15 – Concrete Walks, Curbs and Gutters (where applicable)

.7 Section 33 65 73 – Concrete Encased Duct Banks

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
- .2 ASTM C309-03, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
- .4 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .5 ASTM C1107-02, Standard Specification for Packaged Dry, Hydraulic-cement Grout (Non-Shrink).

.2 Canadian Standards Association (CSA International)

- .1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
- .3 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.

.2 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Submit to Engineer prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.2 Prior to starting concrete work, submit proposed execution and quality control procedures for review by Engineer on following items:

.1 Curing.

.2 Finishes.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to Engineer laboratory representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Engineer.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.3 Waste Management and Disposal:

.1 Divert unused concrete materials from landfill to local quarry and/or facility approved by Authority having jurisdiction.

.2 Provide an appropriate area on the job site where concrete trucks can be safely washed.

.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Authority having jurisdiction.

.4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

Part 2 Products

2.1 MATERIALS

.1 Cement: to CAN/CSA-A3001.

.2 Supplementary cementing materials: CAN/CSA-A3001.

.3 Water: to CSA-A23.1.

.4 Aggregates: to CAN/CSA-A23.1/A23.2. Coarse aggregates to be normal density.

.5 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

.6 Shrinkage compensating grout: premixed compound consisting of cement, based mineral aggregate, water reducing and plasticizing agents to CSA-A23.1/A23.2.

.1 Compressive strength: 50 MPa at 28 days.

.7 Curing compound: to CSA-A23.1/A23.2 white and ASTM C309, Type 1-chlorinated rubber. Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration to Architect that compounds use are compatible.

.8 Mechanical waterstops: ribbed extruded PVC of sizes indicated with pre-welded with legs not less than 300 mm.

.9 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.10 Void Form:

.1 SlabVoid® (4" Minimum Height for exterior application made of corrugated paper with moisture-resistant outer surface) by SureVoid Products or approved equal.

.11 Thermal and Moisture Protection: to Division 7.

2.2 MIXES

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1/A23.2, to give following properties:

.1 For all interior concrete slabs not exposed to freezing and thawing (suspended slabs and slabs on grade):

.1 Cement: Type GU - General Use Hydraulic Cement.

.2 Maximum water/cementing materials ratio: 0.55.

.3 20 mm nominal size coarse aggregate.

.4 Minimum compressive strength at 28 days: 25 MPa.

.5 Class of exposure: Normal.

.6 Chemical admixtures in accordance with ASTM C494.

.7 Slump at time and point of discharge 80 mm $\pm$ 20 mm.

.2 For all interior concrete not exposed to freezing and thawing (interior footings and interior piers, excluding interior slabs) and for concrete to be used within ICF walls:

.1 Cement: Type GU - General Use Hydraulic Cement.

.2 Maximum water/cementing materials ratio: 0.55.

.3 20 mm nominal size coarse aggregate (refer to section 03 11 19 for additional requirements for concrete to be used within ICF walls).

.4 Minimum compressive strength at 28 days: 32 MPa.

.5 Class of exposure: Normal.

.6 Chemical admixtures in accordance with ASTM C494.

.7 Slump at time and point of discharge 80 mm ± 20 mm.

.3 For all exterior concrete (exterior walls and exterior piers, excluding structural slabs at door entrances and exterior equipment pads):

.1 Cement: Type GU - General Use Hydraulic Cement.

.2 Maximum water/cementing materials ratio: 0.55.

.3 20 mm nominal size coarse aggregate.

.4 Minimum compressive strength at 28 days: 32 MPa.

.5 Class of exposure: F-2.

.6 Air content 4% to 7%

.7 Chemical admixtures in accordance with ASTM C494.

.8 Slump at time and point of discharge 80 mm ± 20 mm.

.4 For all exterior structural concrete slabs at door entrances and exterior equipment pads exposed to freezing and thawing:

.1 Cement: Type GU - General Use Hydraulic Cement.

.2 Maximum water/cementing materials ratio: 0.40.

.3 20 mm nominal size coarse aggregate.

.4 Minimum compressive strength at 28 days: 35 MPa.

.5 Class of exposure: C-1.

.6 Air content 5% to 8%

.7 Chemical admixtures in accordance with ASTM C494.

.8 Slump at time and point of discharge 80 mm ± 20 mm.

.5 For ice rink concrete slab, refer to Section 13 17 60 – Ice Rink Slab.

.2 Do not change concrete mix without prior approval of Engineer. Should change in material source be proposed, new mix design to be approved by Engineer.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Engineer's approval before placing concrete.

.1 Provide 24 hour notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix by Engineer.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete (where applicable).

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.

.11 Do not place load upon new concrete until authorized by Engineer.

.1 Do not proceed with backfilling operations of retaining walls until specified concrete minimum compressive strength has reached a value of 30 MPa.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Engineer.

.2 Where approved by Engineer, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Engineer.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Engineer before placing of concrete.

.5 Check locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.4 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.5 Hardening.

.1 Apply floor hardener at locations indicated on architectural drawings at rate considered as light in accordance with manufacturer's written instructions.

.6 Sealing.

.1 Apply floor treatment at locations indicated on architectural drawings in accordance with Sealer manufacturer's written instructions.

.7 Finishing and curing:

.1 Unless noted otherwise, finish, cure and protect concrete in accordance with CAN/CSA-A23.1/A23.2.

.2 Curing and protection of concrete during cold weather (when temperature is at or below 5^0C or when there is a probability of temperature falling below 5^0C within 24 hours of placing) should go on until concrete cylinders stored on site have reached a compressive strength of 30 MPa.

.3 Curing and protection of the concrete should go on until concrete cylinders stored on site have reached 70% of the specified compressive strength at 28 days.

.4 Interior floor slabs to be left exposed, to receive epoxy, carpet, sheet vinyl or other covering requiring a smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CAN/CSA-A23.1/A23.2 to produce hard, smooth, dense trowelled surface free from blemishes.

.5 Floor slabs to receive mortar bed for ceramic or quarry tile: screed to correct grade to provide broomed texture.

.6 Equipment pads (where applicable): provide smooth trowelled surface.

.7 Use procedures as reviewed by Engineer or those noted in CSA-A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.8 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: in accordance with manufacturer’s instructions. Provide written declaration that compounds used are compatible.

.9 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.8 Waterstops:

.1 Where indicated on architectural drawings, install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by Engineer.

.9 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Engineer.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance in accordance with CSA-A23.1/A23.2.

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct following test in accordance with Section 01 40 00 - Quality Requirements.

.1 Concrete pours.

.2 Slump tests.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Engineer for review in accordance with CSA-A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Engineer.

.4 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.

.5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 30 00 – Administrative Requirements.

.2 Section 01 74 00 – Cleaning and Management.

.3 Section 04 26 19 – Reinforced Unit Masonry.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM A325M-00, Specification for High-Strength Bolts for Structural Steel Joints Metric.

.1 ASTM A325 or A490 Test for Slip Coefficient and Creep Resistance in Accordance with the Research Council on Structural Connections for Structural Bolts.

.2 ASTM A500-03a Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

.3 ASTM A572/A572M-04 Standard Specification for High-Strength Low-Alloy Columbian-Vanadium Structural Steel.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).

.1 CISC/CPMA 1-73a, A Quick-drying One-coat Paint for use on Structural Steel.

.4 Canadian Standards Association (CSA International)

.1 CAN/CSA G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-S16-01, Limit States Design of Steel Structures.

.4 CAN/CSA-S136-94(R2001), Cold Formed Steel Structural Members.

.5 CSA-S136.1-95(R2001), Commentary on CSA Standard S136.

.6 CSA W47.1-92(R2001), Certification of Companies for Fusion Welding of Steel Structures.

.7 CSA W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.8 CSA W59-M1989(R2001), Welded Steel Construction (Metal Arc Welding) Metric.

.5 The Society for Protective Coatings (SSPC)

.1 SSPC-SP-1 Solvent Cleaning

.2 SSPC-SP-2 Hand Tool Cleaning

.3 SSPC-SP-3 Power Tool Cleaning

.4 SSPC-SP-6 / NACE No. 3 Commercial Blast Cleaning

.5 SSPC-SP-11 / Power Tool Cleaning to Bare Metal

1.3 DESIGN REQUIREMENTS

.1 Structural design in conformance with the provincial building code latest edition, and the National Building Code of Canada 2010, latest edition.

.2 Structural materials method and design in conformance with the latest edition of all applicable standards and codes.

.3 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.

.4 Shear connections:

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.

.2 If shears are not indicated, select or design connections to resist 50% of the shear capacity of the web of the weaker framing member, unless noted otherwise.

.5 Design all connections as “Bearing Type Connection”, except for moment connections which shall be “Friction Type”.

.6 Design vertical/lateral bracing and corrections in accordance with requirements of CAN/CSA-S16 for seismic-load-resisting system of Conventional Construction type (R_D=1.5, R_0=1.3).

.7 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of New Brunswick, Canada for non standard connections.

.8 All discrepancies in details and dimensions shall be brought to the attention of the engineer prior to commencing related work. Drawings are not to be scaled.

.9 Importance category of building: Normal

1.4 SHOP DRAWINGS

.1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 30 00 – Administrative Requirements.

.2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:

.1 Description of methods.

.2 Sequence of erection.

.3 Type of equipment used in erection.

.4 Temporary bracings.

.3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the province of New Brunswick, Canada.

1.5 QUALITY ASSURANCE

.1 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

Part 2 Products

2.1 MATERIALS

.1 Structural steel:

.1 To CAN/CSA-G40.20/G40.21, Grade 350W or to ASTM A572, Grade 50 for W, HP and WT shapes.

.2 To CAN/CSA-G40.20/G40.21, Class C, Grade 350W or to ASTM A500, Class C, Grade 50 for hollow structural sections.

.3 To CAN/CSA-G40.20/G40.21, Grade 300W for other shapes and plates.

.2 Anchor rods: to ASTM A193, Grade B7, unless indicated otherwise on drawings.

.3 Expansion anchors: KB-TZ 19 mm x 254 mm Kwik Bolt TZ expansion anchor by Hilti (unless indicated otherwise) or approved equal.

.4 Bolts, nuts and washers: to ASTM A325M, unless indicated otherwise.

.5 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.6 Hot dip galvanizing (where applicable): galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m^2.

.7 Shear studs (where applicable): to CSA W59, Appendix H.

.8 Steel elements concealed below finish floor grade

.1 Protective coating: surface tolerant high solids (85% $\pm$ 2%) epoxy mastic coating.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136 and in accordance with reviewed shop drawings.

.2 Install shear studs in accordance with CSA W59 (where applicable).

.3 Continuously seal all HSS members by continuous welds and provide drain holes at low points, unless indicated otherwise. Grind smooth.

.4 Weld metal connections to members, as required, for anchorage of masonry.

2.3 SHOP PAINTING (PRIMER)

.1 Apply one coat of CISC/CMPD 1-73a primer in shop to all steel surfaces to achieve minimum dry film thickness of 2.0 mils.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16 and CAN/CSA-S136.

.2 Welding: in accordance with CSA W59.

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

3.2 MARKING

.1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.3 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136 and in accordance with reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Engineer.

.3 Clean with mechanical brush and touch up painting system to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

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

.5 Steel Contractor shall supply all temporary bracing required to maintain plumbness and stability of steel frame during erection until x-bracing have been erected and roof diaphragm completed.

.6 No openings shall be cut in structural members, unless indicated otherwise on drawings or proper approval is received from Engineer.

.7 Grout under base plates using procedures in accordance with manufacturer's recommendations, which result in 100% contact over grouted area.

3.4 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Engineer.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Engineer.

.3 Owner will pay costs of tests referred in item .1.

.4 Inspection of connections will be carried out during steel erection. The Contractor shall cooperate with and assist the testing company by providing access to all parts of the work as required.

.5 Contractor shall be responsible for their own quality control. Inspection by an independent inspector, the Architect and/or the Engineer will not increase or replace Contractor quality control nor relieve then of their contractual responsibility.

.1 Test shear studs in accordance with CSA W59.

3.5 FIELD PAINTING

.1 Touch up damaged surfaces and surfaces to meet the shop applied painting systems unless specified otherwise.

.2 Protection:

.1 Cover all immediate and adjacent surfaces that are not scheduled for the particular application. This should include all adjacent areas that could be affected by overspray.

.2 Mask or remove any finish hardware not scheduled for painting.

.3 Cover or otherwise protect all surrounding sensitive equipment, including electrical boxes.

.4 Special care shall be exercised to prevent painting over equipment tags and plates, information placards, and color coded safety and warning apparatus.

.5 During coating application place placards outside of immediate area indicating that painting is in progress.

.3 Clean-up:

.1 At completion of application and repair Contractor shall remove from site all evidence of equipment, unused paint materials, and miscellaneous items and sundries.

.2 All spent materials and containers shall be removed from job site and properly disposed.

.3 Contractor shall remove all masking, tarpaulins, protective seals, and signage, from all items previously covered and protected.

.4 Steel elements concealed below finish floor grade

.1 Prepare all steel surfaces to SSPC-SP11 (Power Tool Cleaning to Bare Metal)

.2 Apply surface tolerant high solids epoxy mastic coatings to manufacturer’s recommendation. Apply in two coats of 5.0 mils each.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/National Particleboard Association (ANSI/NPA)

.1 ANSI/NPA A208.1-2009 Particleboard.

.2 ASTM International

.1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A307-14 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.

.4 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM D 5055-13e1, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.

.6 ASTM D 5456[14b, Standard Specification for Evaluation of Structural Composite Lumber Products.

.7 ASTM F1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-11.3-M87, Hardboard.

.2 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.4 Canadian Wood Council

.1 Wood Design Manual 2010 (R2014) Edition

.2 Engineering Guide for Wood Frame Construction 2014

.5 CSA International

.1 CAN/CSA-A123.2-03 (R2013), Asphalt Coated Roofing Sheets.

.2 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.3 CSA O86-14 Engineered Design in Wood

.4 CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.5 CSA O121-08 (R2013), Douglas Fir Plywood.

.6 CSA O141-05 (R2014), Softwood Lumber.

.7 CSA O151-09 (R2014), Canadian Softwood Plywood.

.8 CSA O153-13, Poplar Plywood.

.9 CSA O325-07 (R2012), Construction Sheathing.

.10 CAN/CSA-S406-92 (R2008), Construction of Preserved Wood Foundations.

.11 CAN/CSA-Z809-08, Sustainable Forest Management.

.6 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.

.7 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.8 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

.9 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.10 Sustainable Forestry Initiative (SFI)

.1 SFI-2015-2019 Standard.

.11 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

1.2 QUALITY ASSURANCE

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

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

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 wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include manufacturer’s pre-engineered floor, ceiling and roof joist span charts, and manufacturer’s pre-engineered installation details.

.3 Submit certified test reports for prefabricated structural members from approved independent laboratory indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Submit CCMC Product Evaluation Report for engineered wood products.

.5 Submit manufacturer’s installation instructions.

.3 Shop Drawings:

.1 For structural applications or conditions beyond the scope of the manufacturer's pre-engineered design information, submit drawings stamped and signed by professional engineer registered or licensed in Province of NB, Canada.

.2 Include on drawings:

.1 Design data in accordance with CAN/CSA-O86 and CWC Engineering Guide for Wood Frame Construction.

.2 Indicate configuration and spacing of joists, hanger and connector types, fasteners, locations and design values; bearing details.

.3 Submit stress diagrams or print out of computer design indicating design loads for members. Indicate allowable load and stress increase.

.4 Indicate arrangement of webs or other members to accommodate ducts and other specialties.

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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store materials off ground with moisture barrier at both ground level and as a cover forming a well-ventilated enclosure, with drainage to prevent standing water.

.3 Store wood I-beams and I-joists on edge.

.4 Stack, lift, brace, cut and notch engineered lumber products in strict accordance with manufacturer's instructions and recommendations.

.5 Store and protect architecturally exposed lumber from nicks, scratches, and blemishes.

.6 Replace defective or damaged materials with new.

.7 Store separated reusable wood waste convenient to cutting station and work areas.

Part 2 Products

2.1 STRUCTURAL FRAMING

.1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Plant fabricated structural wood:

.1 Proprietary prefabricated I-joists of solid, laminated veneer lumber glue laminated lumber flanges or oriented strandboard panel web, with factory pre-punched knock-out holes for electrical services and ventilation holes for roof joists.

.2 Proprietary prefabricated open web parallel chord joists of solid, laminated veneer lumber glue laminated lumber flanges or oriented strandboard panel web, and ventilation holes for roof joists with factory pre-punched knock-out holes for electrical services.

.3 Adhesive: Exterior rated phenol-formaldehyde or phenol-resorcinol: to CSA O112.9.

.4 Plant fabrication with quality control in accordance with ASTM D 5055.

.3 Structural Composite Lumber (SCL) in accordance with ASTM D 5456, for following uses:

.1 Laminated veneer lumber (LVL): hip and valley rafters, headers and beams as indicated.

.2 Parallel strand lumber (PSL): headers and beams as indicated.

.3 Laminated strand lumber (LSL): studs as indicated.

.4 Oriented strand lumber (OSL): studs as indicated.

.4 Plywood, OSB and wood based composite panels: to CSA O325.

.5 Canadian softwood plywood (CSP): to CSA O151, standard construction.

2.2 ACCESSORIES

.1 Subflooring adhesive: to CAN/CGSB-71.26, cartridge loaded.

.2 General purpose adhesive: to CSA O112.9.

.3 Nails, spikes and staples: to ASTM F1667.

.4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.6 Joist hangers, connectors and fasteners: in accordance with accepted shop drawings, minimum 1 mm thick sheet steel, galvanized to minimum ZF001] coating designation.

.7 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, fibre, formed to prevent dishing. Bell or cup shapes not acceptable.

.8 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy type approved by Consultant.

.9 Fastener Finishes:

.1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work and interior highly humid areas.

.2 Proprietary corrosion resistant fasteners for pressure- preservative treated lumber: as recommended by manufacturer for material and service conditions and as specified in Section 06 05 73.

.3 Plated finish: use cadmium plated fasteners for interior work.

.10 Wood Preservative: as specified in Section 06 05 73- Wood Treatment.

.11 Sill Plate Gasket: Closed cell polyethylene foam gasket in width to match sill plate width, 6 mm thick.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SYSTEMS INTEGRATION

.1 Install air barrier and vapour retarder sheeting around framing members to ensure continuity of protection and to lap and seal to main sheets.

.2 Install insulation in exterior wall framing cavities that will not be accessible after completion of framing.

.3 Install sill plate gasket in continuous lengths between concrete surfaces and wood framing.

3.3 FRAMING INSTALLATION

.1 Install engineered framing and plant fabricated structural wood components, including all hangers, connectors and fasteners, in accordance with accepted shop drawings and manufacturers’ instructions.

.2 Install members true to line, levels and elevations, square and plumb.

.3 Construct continuous members from pieces of longest practical length.

.4 Install spanning members with "crown-edge" up.

.5 Select exposed framing for appearance. Install [lumber] [panel] materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.7 Countersink bolts where necessary to provide clearance for other work.

.8 Install specified panel product for each application.

.9 Install combined subfloor and underlay with panel end-joints located on solid bearing, staggered at least 800 mm.

.1 In addition to mechanical fasteners, floor panels secure floor subflooring to floor joists using glue. Place continuous adhesive bead in accordance with manufacturer's instructions, single-bead on each joist and double-bead on joists where panel ends butt.

.10 Install wall sheathing in accordance with manufacturer's printed instructions and requirements of NBC.

.11 Install roof sheathing in accordance with requirements of NBC.

.12 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 FURRING AND BLOCKING

.1 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.

.2 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.

.1 Align and plumb faces of furring and blocking to tolerance of 1:600.

.3 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.4 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.5 Install sleepers as indicated.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 06 18 00 – Glued-Laminated Structural Units.

1.2 REFERENCES

.1 National Lumber Grades Authority

.1 NLGA Standard Grading Rules for Canadian Lumber 2005.

.2 CSA-086-09, Engineering Design in Wood (Limit States Design).

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 60 00 – Product Requirements.

2.2 MATERIALS

.1 Wood decking: to NLGA standard Grading Rules for Canadian Lumber Commercial grade Spruce-Pine-Fir Commercial Grade, predrilled at 750 mm on centre for lateral spiking, single tongue and groove and "Veed" one side. Kiln dry decking to 15% maximum moisture content.

.2 Decking lengths: 1.8 to 6 m or longer with a minimum of 90% planks exceeding 3 m. Square end trimmed. For single spans shorter than 3 m use decking of same length as span.

.3 Nails: to CSA B111, hot dipped galvanized finish; sizes as recommended in CAN/CSA O86. Supply 200 mm spiral spikes for lateral nailing.

.4 Splines: galvanized metal, as recommended by decking manufacturer.

.5 Wood preservative: by Division 9.

Part 3 Execution

3.1 INSTALLATION

.1 Do wood deck work in accordance with CAN/CSA O86 except where specified otherwise.

.2 Install decking in accordance with CAN/CSA O86, controlled random pattern (Figure 2.2).

.3 Provide minimum of one bearing support for each plank except extend cantilevers over two supports. Install sloping deck with tongues up. Join butt ends with splines to assure tight square fit.

.4 Stagger end joints in adjacent planks minimum of 0.5 m. Separate joints in same area by at least two intervening courses. Avoid joints in first fifth of end spans. Minimize joints in middle third of span.

.5 Apply preservative to end cuts where pressure treated lumber is specified.

3.2 CLEANING

.1 Remove tool marks, bruises, and scratches.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 30 00 – Administrative Requirements.

.2 Section 06 10 00 – Rough Carpentry.

.3 Section 06 15 00 – Wood Decking.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA International)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.2 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 O86-09, Engineering Design in Wood.

.5 CSA O112.9-10, Evaluation of adhesives for structural wood products (exterior exposure).

.6 CAN/CSA-O122-06 (R2011), Structural Glued-Laminated Timber.

.7 CAN/CSA-O177-06 (R2011), Qualification Code for Manufacturers of Structural Glued-Laminated Timber.

.8 CAN/CSA-S16-09, Design of Steel Structures.

.9 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.

.3 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001 (V4-0) EN, FSC Principles and Criteria for Forest Stewardship.

.2 FSC-STD-20-002 (V3-0) EN, Structure, content and local adaptation of Generic Forest Stewardship Standards.

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.5 Canadian Construction Material Centre (CCMC)

.1 CCMC's Registry of Product Evaluations, October 1st, 2000 On-line Edition (updated quarterly).

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 30 00 – Administrative requirements.

.2 Product Data:

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

.2 Submit WHMIS MSDS in accordance with 01 30 00 – Administrative Requirements.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.

.2 Submit erection drawings in accordance with CSA S16 and CSA O86.

.3 Shop drawings for members: indicate stress grade, service grade and appearance grades, shop applied finishes, camber, cuts, ledgers, holes and connection details.

.4 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Submit manufacturer's plant certification based on the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC) or the product report published by a certification agency accredited by the Standards Council of Canada at completion of fabrication.

.5 Test and Evaluation Reports: submit certified test reports from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.7 Prepare sample of typical beam to beam, beam to column and x-bracing connection details for approval of Engineer. Samples to be judged upon alignment of surfaces, exposed fasteners and aesthetics. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacture structural glued-laminated members in plant certified as meeting requirements of CSA O177.

.2 Submit certificate of conformity based on the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC) or the product report published by a certification agency accredited by the Standards Council of Canada at completion of fabrication.

.3 Fabricator for welded steel connections to be certified to CSA W47.1.

.4 Place, on glued-laminated or cross-laminated members, the material evaluation report number listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC) or the product report number published by a certification agency accredited by the Standards Council of Canada indicating manufactured in certified plant.

.5 Certification of material protective sealer.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 60 00 – Products Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name and address.

.2 Apply protective sealer to glued-laminated units before shipping unless specified otherwise.

.3 Wrap architectural grade members prior to leaving plant with a moisture resistant wrapping.

.4 Use padded, non-marring slings for handling glued-laminated members.

.5 Protect corners with wood blocking.

.6 Make adequate provision for delivery and handling stresses.

.3 Storage and Handling Requirements:

.1 Sore materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Slit underside of membrane covering during storage at site without defacing member.

.3 Store glued-laminated units and protect from weather, block off ground and separate with stripping, so air may circulate around faces of members.

.4 Cover glued-laminated units with opaque moisture resistant membrane if stored outside.

.5 Store and protect glued-laminated products from nicks, scratches, and blemishes.

.6 Replace defective or damaged materials with new, unless written approval by the manufacturer.

Part 2 Products

2.1 MATERIALS

.1 Laminating stock:

.1 Glued-laminated: Spruce FSC Certified, based on the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC).

.2 Columns and beams to be 24F-E.

.1 Adhesive: to CSA O112.10, to grade of service required in accordance with CAN/CSA-O122.

.1 Urea-formaldehyde free.

.2 Sealer for glued-laminated members: penetrating type, clear, non-yellowing liquid.

.3 Fastenings:

.1 Split ring connections: hot rolled carbon steel, SAE 1010, in accordance with SAE handbook.

.2 Shear plate connectors.

.1 Pressed steel type: hot rolled carbon steel, SAE 1010, in accordance with SAE handbook.

.2 Malleable iron type: to ASTM A47/A47M, grade 350.

.3 Lag screws: to ASME B18.2.1.

.4 Bolts: to ASTM A307.

.5 Side plates: to CSA-G40.20/G40.21 or ASTM A36.

.6 Drift pins: to ASTM A307.

.7 Glued-laminated timber rivets: hot dip galvanized to CSA-G40.20/G40.21 or ASTM A36.

.8 Nails and spikes: to CSA B111.

.9 Wood screws: to ASME B18.2.1.

.4 Shop coat primer for steel connections: to CAN/CGSB-1.40.

.5 Galvanizing: to CAN/CSA-G164, hot dipped, minimum zinc coating of 610 g/m^2.

.6 Preservative/Coatings/Paint Finish: by Division 9.

2.2 FABRICATION

.1 Fabricate members to following classifications:

.1 Stress grade:

.2 Glued-laminated: Spruce-Pine 24F-1.9EX for beams and columns, for bending, compression and/or tension members, to the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC).

.3 Service grade:

.1 Glued-laminated timber: Exterior.

.4 Appearance grade:

.1 Glued-laminated timber: Architectural Exposed (Quality).

.2 Mark laminated members for identification during erection. Marks not to be visible in final assembly.

.3 Do not apply sealer to areas which are to receive stained finish or preservative treatment.

.4 Design connections to CSA O86, and CSA S16 unless specifically detailed, to resist shears, moments and forces indicated.

.1 Fabricate in accordance with CSA S16.

.5 Galvanize connections after fabrication.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glued-laminated material installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Engineer.

.2 Inform Engineer of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PRESERVATIVE TREATMENT

.1 Pressure treat all members with preservative in accordance with CAN/CSA O80 Series after fabrication.

3.3 ERECTION

.1 Protect protective sealer from damage before erection.

.1 Touch up damaged areas on site with specified sealer.

.2 Erect glued-laminated members in accordance with for construction erection drawings.

.3 Brace and anchor members until permanently secured by structure.

.4 Make adequate provisions for erection stresses.

.5 Splice and join only at locations as indicated on for construction erection drawings.

.6 Do not field cut or alter members without manufacturer's approval. If approved, preservative treat cut ends.

.7 Erect glued-laminated decking in accordance with for construction erection drawings.

.1 Install glued-laminated decking in a single/ or multiple/span continuous pattern as indicated on the drawings (no controlled random pattern).

.2 When possible, stagger end joints in adjacent elements over supports.

.3 Nail decking to supports and adjacent courses as shown on the drawings. When the underside of the decking is to have an architecture appearance, particular care must be taken when nailing the decking to supports or to adjacent elements, and when nailing other miscellaneous framing to the wood decking, that nails do not penetrate through the full thickness of the decking.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of product..

.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Ensure manufacturer's representative is present before and during critical periods of installation.

.4 Schedule site visits:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, rools and equipment in accordance with Section 01 74 11 – Cleaning.

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by glued-laminated construction installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 03 30 00 – Cast–in-Place Concrete.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C 208-95(2001), Specification for Cellulosic Fiber Insulating Board.
- .2 ASTM C 591-01, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
- .3 ASTM C 612-04, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
- .4 ASTM C 726-05, Standard Specification for Mineral Fiber Roof Insulation Board.
- .5 ASTM C 728-05, Standard Specification for Perlite Thermal Insulation Board.
- .6 ASTM C 1126-04, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- .7 ASTM C 1289-05a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .8 ASTM E 96/E 96M-05, Standard Test Methods for Water Vapour Transmission of Materials.

.2 Canadian Gas Association (CGA)

- .1 CAN/CGA-B149.1-05, Natural Gas and Propane Installation Code Handbook.
- .2 CAN/CGA-B149.2-05, Propane Storage and Handling Code.

.3 Canadian General Standards Board (CGSB)

- .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.4 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC-S604-M91, Standard for Type A Chimneys.
- .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .3 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .4 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

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

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material.

Part 2 Products

2.1 INSULATION

.1 Underslab and foundation insulation: expanded polystyrene, to CGSB 51-GP-20M, Type 4 of thickness indicated.

.1 Type: 4.
.2 Compressive strength: 275 kPa (40 psi) minimum.
.3 Thickness: 2 - 51mm layers.
.4 Size: as required.
.5 Edges: square.

2.2 ACCESSORIES

.1 Tape as recommended by insulation board’s manufacturer.

Part 3 Execution

3.1 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.

3.2 WORKMANSHIP

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.3 Offset both vertical and horizontal joints in multiple layer applications.

.4 Do not enclose insulation until it has been inspected and approved by Engineer.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Engineer-Architect in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 PERIMETER FOUNDATION INSULATION

.1 Install boards horizontally under the entire concrete slab as indicated on drawings. Lay boards on level compact fill.

3.5 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 GENERAL

1.1 DEFINITIONS

.1 Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."

.2 HDPE: High-density polyethylene.

.3 IPEMA: International Play Equipment Manufacturers Association.

.4 LLDPE: Linear low-density polyethylene.

.5 MDPE: Medium-density polyethylene.

.6 Use Zone: According to ASTM F 1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.2 SUBMITTALS

.1 Product Data: For each type of product indicated.

.2 Shop Drawings: For playground equipment and structures. Include plans, elevations, sections, details, and attachments to other work.

.3 Samples for Initial Selection: For each type of playground equipment and structure indicated.

.1 Manufacturer's color charts.

.2 Include similar Samples of playground equipment and accessories involving color selection.

.4 Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

.1 Extent of surface systems and use zones for equipment.

.2 Critical heights for playground surfaces and fall heights for equipment.

.5 Qualification Data: For qualified Installer and manufacturer.

.6 Product Certificates: For each type of playground equipment, from manufacturer.

.7 Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of playground equipment.

.8 Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

.9 Warranty: Sample of manufacturer’s standard warranty.

1.3 QUALITY ASSURANCE

.1 Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

.1 Provide playground equipment and play structure components bearing the IPEMA Certification Seal.

.2 Installer Qualifications: An employer of workers approved by manufacturer.

.3 Safety Standards: Provide playground equipment complying with or exceeding requirements in ATM F 1487 or CPSC No. 325.

1.4 WARRANTY

.1 Lifetime limited warranty on support posts (uprights)

.2 15 year limited warranty on punched steel decks, pipes, rails, loops and rungs

.3 15 year limited warranty on rotomolded polyethylene components

.4 Lifetime limited warranty on powerlock and hardware

.5 All other components: Minimum 1 year warranty.

.6 Include all warranty information in close out submittals.

Part 2 PRODUCTS

2.1 COMPONENTS

.1 Components: All components of each set of play equipment features within one playground shall be from a single manufacturer. The manufacturer of the playground equipment must have a minimum of 10 years experience in manufacturing commercial playground equipment.

.2 Supply and install the following play equipment components supplied by the Contractor for this project.

.1 Manufacturer: Gametime

.2 Contact: Isabelle Viens, Sales Representative, Tessier Recro-Parc, 1-800-8385-8591, iviens@tessier-rp.com

.3 Main Structure TOKK210610PT

.1 Double Wave Zip Slide

.2 Wave Zip Slide

.3 Spiral Step Climber

.4 Sloped Funnel Climber

.5 Plank Climber

.6 Steering Weheel

.7 Rock Steps

.8 Erratic Climber

.9 DNA Climbing Wall

.10 Wave Tree Climber

.11 Fun Seat
.12 Bongo Panel
.13 Timber Slant Roof
.14 Rung Enclosure
.15 Ripple Pass
.16 Rockscape
.17 Small and Large Tree
.18 Punched Steel Stairs
.19 5 Decks

.4 Solo Spinner (6246) – Qty 1

.5 Centrix (36035) – Qty 1

.6 Double Bay Swing (TRP-SBPS9202/P AND TRP-SBP29212/P):

.1 8' high 2 bay swing with 3 1/2" OD upper post and 5" OD frame. Including 2 straight seat (1483), 2 bucket swings seat (1470), anti-wrap swing hangers and galvanized chains.

.1 Location and arrangement of play equipment is indicated on the drawings.

.2 Assembly requirements of apparatus as per manufacturer's recommendations.

.3 Colors: Color palette to be selected from standard range.

2.2 DELIVERY AND STORAGE

.1 The Contractor shall be responsible for taking delivery and storing of play equipment until ready for installation.

.2 The Contractor is solely responsible for the supply of all loading and transfer equipment and manpower required to move and store the play equipment, and for any/all damage or loss to the equipment starting at the date of delivery.

.3 Inspection Before Loading: Inspect the equipment at the site of delivery, document and notify the Owner of any apparent damage or missing components.

.4 Transportation: Transportation of the equipment to the site shall be scheduled to coincide as closely as possible to the actual time of installation. The Contractor is responsible for the security of the play equipment once it has been delivered from the manufacturer.

2.3 FOOTINGS

.1 Direct embedment type in cast-in-place concrete. Minimum footing depth shall be 1800 (72”) mm below playground surfacing subgrade.

.2 Layout: Arrange on site as indicated

Part 3 EXECUTION

3.1 EXAMINATION

.1 Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, site surface and subgrade drainage, and other conditions affecting performance of the Work.

.2 Do not begin installation before final grading required for placing protective surfacing is completed unless otherwise permitted by Landscape Architect.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Verify locations of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

.1 General: Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

.2 Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

.3 Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

.4 Post Set with Concrete Footing: Comply with ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.

.1 Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

.1 Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

.2 Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.

.3 Concrete Footings: Smooth top, and shape to shed water.

3.4 FIELD QUALITY CONTROL

.1 Inspections.

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, for safety standards

.2 Tests and Inspections: For playground and playground equipment and components at final completion and to certify compliance with ASTM F 1487 and CPSC No. 325.

END OF SECTION

Part 1

1.1 RELATED SECTIONS

1.2 MANUFACTURER:

.1 Manufacturer: Vortex Aquatic Structures Intl., Montreal, QC. 1-877-586-7839 / Atlantic Region Representative- ABC Recreation Ltd. (506) 577-8346 or 1-800-267-5753.

1.3 STANDARDS

.1 Manufacturer shall have a minimum 10 years experience in the manufacture of aquatic play features and components. The person(s) responsible for installation shall have supervised/installed a minimum of 3 (three) installations in Atlantic Canada.

.2 Manufacturer shall provide independent and accredited certification that it applies an environmental management system which meets the requirements of ISO 14001:2004 in its design, manufacturing, sales, marketing and servicing of recreational aquatic products and accessories.

.3 Manufacturer shall provide independent and accredited certification that it applies a quality management system which meets the requirements of ISO 9001:2008 in its design, manufacturing, sales, marketing and servicing of recreational aquatic products and accessories.

.4 The person(s) responsible for installation shall be on-site performing such service.

.5 Licensed plumbers and electricians shall be used as required by local codes.

.6 Meet ASTM F2461-09.

1.4 General Requirements:

.1 The aquatic play features shall be suitable for installation in aquatic facilities and public play areas. They shall be specifically designed for use by children and adults and be manufactured by a company with a minimum of ten years experience in the design and engineering of children’s aquatic play areas.

.2 Water features and water distribution system shall be equal in every respect to Vortex system specified.

.3 Applications for consideration as equivalent or equal shall provide complete product drawings, written specifications, product data and samples.

.4 The manufacturer shall be required to offer a complete automation system, consisting of a water distribution system and a user-activated controller to regulate the use of the play features.

.5 The water distribution system manifold body must be fabricated out of stainless steel and be offered in a external cabinet. The water distribution system must be pre-assembled and factory tested, and come complete with all the necessary plumbing and pre-wired solenoid valve.

.6 The external cabinet shall serve as the housing for the manifold, and electrical system.

.7 The Contractor shall be responsible for the excavation, base preparation, concrete placement and finish, reinforcing, according to the manufacturer's requirements of the system, and approved shop drawings.

1.5 OPERATION

.1 The activator shall have no moving parts and run on 120V voltage electrical supply from designated service location. It shall be the direct interface between the users of the aquatic play area and the aquatic play features. The pre-programmed sequence of the aquatic play features shall be activated only when triggered by the user.

.2 Programmable run time up to 2 minutes following activation.

1.6 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 pool systems equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings for all components of the spray feature equipment including but not limited to, spray features, distribution system, controllers, piping, installation details, and electrical equipment.

.4 Closeout Submittals:

.1 All aquatic play features are to carry a minimum warranty of two (2) year on all workmanship and materials. Submit warranty to Owner.

.1 The Water Distribution System and Automation System shall be warranted from the manufacturer for a period of not less than two years.

.2 Stainless steel aquatic play features and stainless steel anchoring systems shall be warranted for not less than 25 years. Brass components and high density polyethylene components, polyurethane components and ultra high molecular weight polyethylene components shall be warranted for not less than five years.

.3 Color coating and moving parts shall be warranted for not less than two years.

.2 Provide maintenance and winterizing data.

1.7 DELIVERY, STORAGE AND HANDLING

.1 All aquatic play features must be properly wrapped and secured in place while in transport to the project site.

.2 At the site, the features are to be stored in safe areas, out of the way of traffic and other construction activities, until the actual time of installation.

.3 If required, safety barricades or other like precautions must be taken for the protection of public and adjacent property.

.4 Exercise care in the handling of the features to prevent excessive stress and abrasions.

.5 Protective wrapping on the aquatic play features must be left in place until construction work for the Splashpad is complete.

1.8 QUALITY ASSURANCE

.1 It shall be the obligation of the Contractor to insure that all criteria are satisfied and the burden of proof of conformance shall rest with the contractor. The Consultant shall be the sole judge of conformance and the Contractor is cautioned that he will be required to Bid and provide a finished product meeting all stated criteria.

.2 All products shall be shipped from a single source.

.3 Testing: all aquatic play feature lead lines shall be water pressure tested as directed by local codes and the manufacturer's recommendations before backfilling and pouring of concrete slabs. The contractor is to ensure all water supply lines are free of debris, and flushed of any foreign material, prior to the hook-up of any aquatic play features, and the contractor shall have inspected the entire system (including all electronic systems) in the presence of the owners representative. The contractor is to ensure all nozzles are adjusted and secured to the owner's satisfaction.

.4 All watertight components to be factory pressure tested.

Part 2 Products

2.1 WATER PLAY COMPONENTS:

.1 All aquatic play features will be constructed of type 304/304L stainless steel and will be supplied with all necessary anchoring hardware and installation templates, and shipped in a time to accommodate site work. The features shall come complete with a water inlet and electrical grounding lugs. Fibreglass, PVC or other materials will not be accepted.

.2 All above ground aquatic play features shall be sandblasted and will receive a weather resistant polyurethane, baked on, powder-coat finish. Coatings shall have a gloss finish with ultraviolet inhibitors and fire retardants.

.3 All embedded aquatic play features shall be constructed of stainless steel 304/304L.

.4 Aquatic play features should meet ASTM F2461 Standard Practice for Manufacture, Construction, Operation and Maintenance of Aquatic Play Equipment.

.5 All grade level aquatic play features shall be furnished with appropriate winterization caps or a method to winterize.

.6 Nozzles, spray heads, spray caps and winter caps shall be constructed of C360 Brass and/or stainless steel, and be fastened and removed from the play features using tamper resistant tools specifically designed for use with the nozzles, spray heads, spray caps and winter caps. The nozzles, spray heads, spray caps and winter caps shall be recessed into the aquatic play features to avoid protrusion hazards. Delrin©, fiberglass and other materials will not be accepted.

.7 All anchoring; hardware, plates and flanges, shall be constructed of stainless steel and will be indicated on the shop drawings, as they may be required to complete installation. An

anchor design allowing for the replacement of features should be available as an option. Fibreglass, PVC or other materials will not be accepted.

.1 SAFESWAP™ No1, 55000.0430

.2 SAFESWAP™ No2, 55000.0570

.8 An accessory kit shall be provided by the manufacturer of the aquatic play features, consisting of the necessary tamper resistant tools and touch-up paint. This kit is to be surrendered to the owner once installation is completed.

.9 Equipment to be supplied by Owner and Installed by contractor:

.1 One (1) Bollard Activator VOR-611.2008, The activator shall have no moving parts and run on a low voltage electrical supply. A capacitive sensorswitch to be used as an interface for processing user input activation. The activation cap shall consist of a high impact-resistant protective cap. Complete with safeswap anchor and toe guard, stainless steel, powder coated (colour TBD);

.2 One (1) Playsafe Drain Drain No1, VOR-1001.4000, removable cover, anti-skid surface, strainer basket.

.3 Two (2) Silhouette No.2 VOR-7773.2008, 3GPM/11LPM, complete with safeswap anchor and toe guard, stainless steel, brass nozzles, powder coated (colour TBD);

.4 One (1) Spidey Spray N°2 VOR-7674.0000, 26LPM/7GPM, embedded anchoring and levelling, stainless steel, low flow brass nozzle.

.5 One (1) Fountain Spray No 1, VOR-7513, 19 LPM/5 GPM, complete with safeswap anchor, stainless steel, low flow brass nozzles.

.6 Two (2) Ground Geyser VOR-301.4100R03, 19 LPM/5 GPM, complete with safeswap anchor, stainless steel, low flow brass nozzle.

.7 One (1) Aqua Dome No 1 VOR-555.2000, 38LPM/10GPM, complete with safeswap anchor, stainless steel, low flow brass nozzle.

.10 Equipment to be supplied and installed by contractor:

.1 Two (2) Fountain Spray No 1, VOR-7513, 19 LPM/5 GPM, complete with safeswap anchor, stainless steel, low flow brass nozzles.

.2 Two (2) Ground Geyser VOR-301.4100R03, 19 LPM/5 GPM, complete with safeswap anchor, stainless steel, low flow brass nozzle.

.3 One (1) Bamboo Flower No.1, VOR-7723, 6 GPM/15.1 LPM, complete with safeswap anchor, stainless steel, low flow brass nozzles.

.4 One (1) Spray Loop, VOR 0519, 7 GPM/28LPM, complete with stainless steel, low flow brass nozzles.

.5 Two (2) Tube No.1, VOR 0220, 5 GPM/19 LPM, complete with safeswap anchor, stainless steel, low flow brass nozzles.

.6 One (1) Turtle No. 2, VOR 7216, 12.5 GPM/47.3 LPM, complete with safeswap anchor, stainless steel, low flow brass nozzles.

.7 One (2) Twinsplash, VOR 7242, 12 GPM/45.4 LPM, complete with safeswap anchor, stainless steel, low flow brass nozzles.

2.2 WATER DISTRIBUTION SYSTEM:

.1 The water distribution system shall be factory assembled and water pressure tested before delivery.

.2 Water distribution system to be equipped with water meter. Refer to civil for detail.

2.3 EQUIPMENT CABINET 10 (EC10)

.1 Enclosure cabinet to be supplied by Owner and installed by Contractor. Internal components to be supplied and installed by Contractor.

.2 This above grade equipment cabinet with up to ten (10) valves shall be a pre-fabricated water distribution system containing piping, valves and electrical wiring. They shall be factory assembled, water pressure tested and delivered from the Splashpad equipment manufacturers facilities. They shall be equipped with threaded connections for the water inlet and slip-on for water outlets. The solenoid valves shall be pre-wired to the controller or to a junction box when the controller is placed in a remote location. The installer shall provide the plumbing equipment required from the water source to the water inlet or backflow preventer device and pressure regulator if so configured. The installer shall provide the plumbing equipment required from the water outlets to the Splashpad Play Products, as well as adequate drainage ball valves at the low point of each of the Play Product's water distribution lines when required. Should the controller be located remotely, the installer shall supply the electrical equipment required from the power switch with branch.

.3 Electrical Connections: All main power electrical connections to the Splashpad Controller are to be performed per local codes.

.4 Drawings and Instructions: Product drawings and installation manuals shall be supplied by the manufacturer for ease of installation

.5 General materials specifications

ITEM	MATERIAL	ELECTRICAL	OVERALL DIMS	COATING	PAINT	QTY	Additional information
Chassis	Pre-galvanized steel U channel	-	(35X48X21)" (89X122X53)cm	Electroplated Zinc	-	1	No sharp edges
Manifold	4" Ø SS304 pipe with 10 1-1/2" NPT 1outlet connexions	-	32" 81cm	-	RAL 5017	1	Buffed and watertight weldings 150PSI pressure tested No sharp edges
Compound pressure gauge	SS304 / Brass	-	2-1/2" Ø 5cm Ø	-	-	1	-30 ~ 60PSI reading 1/4" NPT connexion
Mounting hardware	SS304	-	-	-	-	6	Anchor kwik bolts to anchor cabinet on concrete base
Tamper proof hardware	SS304	-	-	-	-	2	
Tamper proof hardware Allen key	SS304	-	-	-	-	2	
Piping	SCH 40 PVC	-	-	-	-	N/A	150PSI pressure tested

1 NPT : National Pipe tapered thread

Outlet: 1-1/2" solenoid	PVC or BRASS	24Vac	-	-	-	5	With or without ball valve Water resistant solenoid Rated up to 150PSI
Inlets: 2" PR 2& BFR3	PVC and Brass union	-	-	-	-	1	Each inlet with 2" pressure regulator (PR) and 2" backflow regulator (BFR)
Controller: Smartflow	-	120Vac	(10X12X7)" (26X31X18)cm	-	-	1	See controller specification sheet for detailed information

2.4 TRACE WIRING:

.1 All splash pad water supply and distribution piping shall be equipped with 18AWG FT4 grey unshielded cable attached to piping for future locating purposes.

2.5 DRAIN COVER:

.1 The drain grating shall have an anti-skid surface consisting of polyurethane based paint.

.2 The drain grating shall have openings no larger than 4.5mm (3/16").

.3 The drain grating shall be secured using stainless steel tamperproof hardware.

.4 The deck drain shall be capable of handling 757 LPM (200 GPM) flow at a maximum of 0.46 m/sec (1.5 ft/sec).

.5 The drain shall have a 200mm (8") PVC outlet.

Part 3 Execution

3.1 INSTALLATION

.1 Verification of Conditions:

.1 Examine all fixtures and components and verify that equipment is undamaged and ready for field assembly.

.2 Return damaged and non-conforming products to the manufacturer.

.3 Identify location of underground utility lines on surface.

.2 Protection:

.1 Protect adjacent facilities, plants, trees, ground covers, grass, paved surfaces, and other site improvements from damage during assembly and installation.

.3 Layout and Excavation:

.1 Lay out aquatic play features, components and supply and drain lines within slab.

.2 Excavation for Foundation: All excavation shall be cut accurately to required lines and dimensions for work on drawings, and shall be large enough to provide adequate clearance for the proper execution of the work within them.

.4 Concrete Placement and Cast in Place Footings:

.1 Obtain approval from Owner's Representative prior to pouring concrete.

2 PR : Pressure regulator
3 BFR : Backflow preventer

.2 Inspection: When the excavation has been carried to the required depth as shown on the drawings, the Contractor shall do no more work until after the inspection by the Engineer, who shall order the foundation work to proceed, or further excavation as the conditions indicate, and no other work shall be done until the excavation has been approved by the Engineer.

.5 Installation

.1 Aquatic play features shall be installed in accordance with the manufacturer's specification, and approved by the owner. The contractor shall use extreme care when installing aquatic play features. All wrappings are to be left intact through installation and then to be removed upon completion.

.2 Entire assemblies shall be installed in accurate location, square and plumb, and in required location to surrounding finished grade, on footings, as shown on the plans. Prior to park commissioning all features must be flushed with potable water and the water balanced should a water treatment system be part of the project

.3 An owner/operator training meeting must be conducted and documented prior to handoff of the project.

3.2 COMMISSIONING:

.1 Upon completion of construction, the general contractor shall provide the owner/operator adequate training on facility operations and maintenance. The equipment manufacturer and/or manufacturer’s representative provide on-site start-up and training for the owner/operator.

Part 1 General

1.1 GENERAL

.1 All provisions of the Bidding Requirements, Contract Forms, Conditions of Contract and Division 1 – General Requirements apply to and govern this Section.

1.2 RELATED WORK

.1 Section 31 23 33-01 – Excavating, Trenching and Backfilling.

.2 Section 03 20 00 – Concrete Reinforcing.

.3 Section 03 30 00 – Cast-In-Place Concrete.

.4 Section 07 21 13 – Rigid Insulation.

1.3 WORK INCLUDED

.1 Final grading and compaction of granular base.

.2 Supply, grading and compacting of sand fill beneath the insulation (coordinate for installation of subsoil heating piping in sand layer).

.3 Installation of board insulation.

.4 Concrete rink slab including reinforcement, supports and inserts (coordinate for installation of rink chairs).

.5 Hardening, finishing and curing of slab.

1.4 WORK NOT INCLUDED

.1 Plastic piping and rink chair supports by Mechanical Contractor.

1.5 REFERENCE STANDARDS

.1 CAN/CSA-A23.1-14: Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-A23.2-14: Methods of Test for Concrete.

.3 CSA CAN3-A23.3-04: Design of Concrete Structures for Buildings.

.4 Do concrete work to the reference standards unless noted otherwise, including storage, proportioning, mixing, placing, compacting, screeding, surfacing, testing, curing (in hot and cold weather), design and use of forms, and placing of reinforcement.

1.6 QUALIFICATIONS

.1 Only pre-approved specialty firms will be accepted as qualified for installation of ice rink slab.

.2 Submit proof of installation of similar slabs which have been in continuous satisfactory operation for not less than two years.

1.7 INSPECTION AND TESTING

.1 Testing of sub-base, structural fill and concrete will be carried on by a testing company designated by the Engineer. Testing company costs will be paid by Owner.

.2 Compaction tests of sub-base and structural fill will be made on the basis of one test per 50 square metres of floor area.

.3 Submit proposed mix designs for approval to testing company.

.4 The testing company will supervise pouring and finishing of the slabs. Concrete tests will be carried out by the testing company at the commencement of the pour, near the end of the pour and at the one-third and two-thirds points of the pour. Each test will consist of a set of three cylinders. In addition, the slump, air content and temperature of the concrete will be monitored continuously by the testing company.

1.8 GUARANTEE

.1 Provide a recognized Surety Company's Guarantee Bond, indemnifying of Owner for a period of two (2) years against damage caused by cracking, shrinking, dusting of concrete or any other defects under this Contractor's control. This shall form a specific guarantee to the Owner.

Part 2 Products

2.1 MATERIALS

.1 Granular Fill: as per details on Drawing F2C.

.2 Rigid Insulation: to CAN/CGSB-51.20-M, Type 4, two (2) layers of 51 mm thick, square edge, with a minimum compressive strength of 275 kPa (40 psi).

.3 Wire Mesh: to CSA G30.5-M, 152 x 152 x MW18.7 x MW 18.7 welded wire fabric flat sheets only.

.4 Reinforcing Bars: to CAN/CSA-G30.18, Grade 400.

.5 Reinforcing Accessories: provide wire ties, spacers and supports required to properly install and secure reinforcing, ice rink piping and slab inserts.

.6 Water and Aggregates: to CAN/CSA-A23.1 except that at least 25% of all coarse aggregate shall be crushed material.

.7 Cement: to CAN/CSA-A3001, normal Type GU.

.8 Water Reducing Admixtures: to ASTM C-494 (to be used only where essential to obtain characteristics noted).

.9 Floor Hardener: non-metallic dry-shake floor hardener such as "MasterTop 100" by Master Builders Ltd., or approved equal.

2.2 MIX DESIGN

.1 Concrete for the rink slab shall have the following characteristics:

.1 35 MPa minimum compressive strength at 28 days.

.2 0.45 maximum water to cement ratio by weight at the end of the delivery hose.

.3 Aggregate: Group 1, 14-5 mm nominal size.

.4 80mm maximum slump at the supply truck.

.5 Super plasticizers to be added at the truck to provide slump of approximately 120 mm at the nozzle for workability to the satisfaction of the installer.

.6 Natural air content only (approximately 2%).

Part 3 Execution

3.1 INTERMEDIATE GRADING AND COMPACTION

.1 From structural fill, raise to elevation 118.500 metres with granular sub-base material specified in Section 32 11 23 in horizontal layers of 300 mm thick maximum. Compact each layer to 95% maximum dry density to ASTM D-1557 (Modified Proctor) using a vibratory roller

.2 On completion of compaction, arrange for the testing company to conduct compaction tests.

3.2 INSTALLATION OF INSULATION

.1 Starting at one end of the rink set and maintain insulation exactly level. Apply two (2) layers as shown on drawings. Use a surveyor's level or a laser system to check the elevation.

3.3 FINAL GRADING AND COMPACTION

.1 From insulation, raise to elevation 119.050 metres with granular sub-base material specified in Section 32 11 23 in two horizontal layers, 300 mm thick and 150 mm respectively. Compact each layer to 95% maximum dry density to ASTM D-1557 (Modified Proctor) using a vibratory roller.

.2 Raise to elevation 119.200 metres with Base 31.5 mm crushed gravel specified in Section 32 11 23. Compact to 95% maximum dry density to ASTM D-1557 (Modified Proctor) using a vibratory roller.

.3 On completion of compaction, arrange for the testing company to conduct compaction tests.

3.4 INSTALLATION OF REINFORCEMENT

.1 Review reinforcing details with the Architect/Engineer to confirm the pattern required.

.2 Send details of engineered steel and/or plastic chairs for approval. Once approved, installed the reinforcements support chairs at 900 mm c/c each way.

.3 Install low layer of wire mesh over entire floor area in position and with overlapped as indicated on drawings.

.4 Install the support chairs for the upper layer of 16 mm diameter reinforcement bars at a maximum spacing of 900 mm c/c each way.

.5 Secure the 16 mm diameter reinforcement with steel wire. Reinforcement shall be space at 250 mm c/c each way. Locate the reinforcement lap in order to have less than 50% of rebar interrupted at the same location. Lap the rebar for a minimum distance of 600 mm.

3.5 INSTALL INSERTS

.1 Install inserts for rink boards and lead plug. Submit certificate that this work was done under the supervision of the refrigeration subcontractor.

NOTE: Final elevations of tops of inserts must be absolutely flush with finished slab surface elevation.

3.6 PLACING CONCRETE

.1 Notify Engineer and Testing Company minimum of 2 working days prior to placing concrete.

.2 Obtain Architect/Engineer approvals of reinforcement and piping installation prior to placing concrete.

.3 Set screeds to ensure a dead level surface finish. The maximum allowable variance in surface elevation of the finished slab along a 3 metre straight edge laid on the slab shall be 3 mm. The maximum allowable variation from the finished elevation is 6 mm +/-.

.4 Carry out pouring and finishing in a continuous operation. Make arrangements for the changing of working crews so there is no break in the pouring of concrete at any time. Stagger meal hours in order to maintain pour continuity. Have a spare concrete pumper available in case of equipment breakdown to ensure continuous operation.

.5 After placing, screed concrete and compact with a high-frequency vibratory screed. Further level and compact the slab with a rotary steel trowel with the trowels set fairly flat, using an average of three passes. Carefully remove excess water brought to the surface prior to the final finish.

.6 Tool edge of rink slab to a smooth bull-nose profile.

3.7 FINISHING CONCRETE

.1 Apply floor hardener in accordance with manufacturer’s recommendations at the rate of 4 kg per square metre.

.2 Finish concrete slab in a continuous operation under supervision of the testing company. Use mechanical means to ensure a true, level slab, free of all voids and cracks.

.3 Protect finished concrete slab from damage during course of construction.

3.8 CURING

.1 Upon completion of the floor finishing, cure the entire floor area by ponding with clean potable water. Maintain the ponding for a period of at least 7 days if the ambient temperature is above 10°C, at least 14 days if the average ambient temperature is below 10°C.

.2 Prevent traffic on the slab for two days after slab completion.

.3 Prevent loading other than foot traffic on the completed slab for a period of seven days.

.4 Prevent vehicle wheel loading heavier than 900 kg on the completed slab for a period of twenty-eight days or until concrete tests indicate that 35 MPa strength has been achieved.

.5 Do not circulate refrigerant until the slab has cured for a minimum of twenty-eight days.

3.9 INSERTS

.1 Install lead plugs being careful not to damage rink piping.

3.10 ADJUSTMENTS

.1 Make good variations from the specified surface elevation and finish to the satisfaction of the Architect/Engineer.

END OF SECTION

1.1 SECTION INCLUDES

.1 The work of this Section shall include, but not be limited to, the following:

.1 Manufacture, supply and installation of complete factory prefabricated, outdoor In-line arena board system.

1.2 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete

1.3 REFERENCES

.1 ASTM B221-93 Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

1.4 SYSTEM DESCRIPTION

.1 Panelized arena board system of prefabricated, lightweight, removable modular panel sections having structural aluminum framing and high density polyethylene (UV-STABILIZED HDPE) facing, 1067 mm (3'-6") high and not more than 2440 mm (8'-0") long with cap rail, kickplate, thresholds. Depending on the application, a minimum 5” deep profile is required.

.2 Gates and hardware.

.3 Permanent anchor bolt system for securing to concrete substrate.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 All materials to be delivered on site and unloaded in a safe manner.

.2 Delivery is to be arranged with owner and/or their represent.

.3 Manufacturer shall field verify all site conditions and measurements.

1.6 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design aluminium members in accordance with CAN3-S157.

1.7 SUBMITTALS

.1 Shop Drawings

.1 Shop drawings shall show, in appropriate scale, dimensions, details of arena board system, methods of joining, fastening, joint locations, finish of materials, methods of anchoring, sizes of anchorage’s, hardware, installation procedures, details of other pertinent components of the work, and adjacent constructions to which work of this Section will be attached.

.2 Shop drawings shall indicate dimensioned layout and placement drawings for installation of floor inserts.

.2 Samples

.1 Submit samples of materials, finishes and colours for review.

.3 Operation and Maintenance Data

.1 On completion of installation, supply three copies of instructions covering removal and replacement of panel system, adjustments and other relevant operating and maintenance data.

1.8 QUALITY ASSURANCE

.1 Qualifications: A firm having a minimum of 5 years satisfactory experience supplying and installing arena boards.

.2 Manufacturer to employ persons skilled in this trade and proficient in the use of materials specified.

.3 Installation or site work must be performed by qualified and experienced personnel.

1.9 PROJECT/SITE CONDITIONS

.1 Environmental Requirements: Ensure that installation takes place only, when temperatures and other conditions are suitable for safe and proper installation.

.2 Field Measurements: Verify location and layout of arena gates. Final arena board anchor insert locations shall be co-ordinated between Contractor, manufacturer and floor installer.

1.10 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship for a period of One (1) year from the date of substantial completion of the contract. Misuse, abuse and/or accident not caused by normal use excluded.

1.11 MAINTENANCE - EXTRA MATERIALS

.1 Supply, in addition to quantities required for the Work, extra materials and products to be stored by the Owner as follows:

.1 Fifty additional painted screws of each colour required for fastening of UV-STABILIZED HDPE facings.

.2 Deliver extra stock to Owner in cartons clearly labelled to identify contents as soon as permanent, locking storage facilities are available. Place extra stock in the designated storage area where directed.

Part 2 Products

2.1 MANUFACTURERS

.1 The following manufacturers are acceptable:

.1 Athletica Sport Systems Inc., Waterloo, ON, Canada, N2L 5Z4 Phone (519) 747-1856 Toll Free Phone (877) 778-5911 Fax (519) 747-3659

.2 Other approved manufacturer, meeting the requirements of this Section, and complying with the provisions of the contract. Mill finished, welded aluminum components or welded galvanized steel framing are not equivalent.

.2 Use of specific requirements set forth in the specification does not preclude the use of equivalent products by approved manufacturers, but are given for the purpose of establishing a standard of design, quality of materials, product content, construction and workmanship.

2.2 MATERIALS

.1 Aluminum Extrusions: ASTM B221, 6005-T5 alloy and temper, in a Clear Anodized finish.

.2 High Molecular Weight Polyethylene: High impact, integrally coloured, high-molecular polyethylene, bright white and other colours as specified, UV stabilized for outdoor applications.

.3 Hardware: Stainless steel.

.4 Fasteners: Zinc plated steel unless otherwise specified.

.5 Anchors (for arena board panels): Stainless Steel.

2.3 FABRICATION

.1 General

.1 As far as practical, execute fitting and assembly in the shop with the various parts or assemblies ready for erection at the project site.

.2 Accurately fit together all joints, corners and intersections. Match components carefully to produce continuity of line and design.

.3 Provide devices for anchoring the assemblies to the substrate with adjustment to permit correct and accurate alignment.

.4 Fabricate anchoring and board support devices required to secure the work of this Section. Supply anchors and layout drawing, where required to be built into work of other Sections.

.5 System components shall be numbered for ease of installation, disassembly, and reinstallation.

.2 Arena Panels

.1 Arena panels shall be factory prefabricated in demountable sections. The design of all panels whether straight, curved or in which a gate is located shall be similar. Each panel shall be made of extruded aluminum box sections with mill finish or clear anodized finish assembled into frames using high strength fasteners. No welding can be done to the aluminium extrusions. Frames shall allow for fastening of the UV-STABILIZED HDPE facing and anchoring at base. Ensure flush mating of the UV-STABILIZED HDPE facing at arena panel joints.

.2 Typical sections shall consist of three vertical posts and three horizontal stringers. Frames shall be connected end to end with heavy-duty bolts and shall be connected to support structure at the posts with aluminum anchor brackets.

.3 Standard size of straight arena panels shall be 2438 mm (8'-0") long, 1067 mm (3'-6")high.

.4 The playing surface side of the arena panel shall be faced with 12 mm (1/2") nominal thickness, high molecular, integrally coloured white high density polyethylene (UV-STABILIZED HDPE) facing. Both sides of the arena facing shall have smooth surfaces. Colour of arena facing shall be identical on both sides. Outdoor applications to have ultra violet stabilised, high-molecular weight polyethylene.

.5 The UV-STABILIZED HDPE facing shall be attached to the arena board framing with 6 mm (1/4") diameter screws. Heads of screws shall be painted to colour match arena facing, kickplate or cap rail sill as appropriate. Spacing of the screws shall not exceed 305 mm (12") on centre.

.6 Provide a 12 mm (1/2") thick colour impregnated UV-STABILIZED HDPE cap rail fastened to top horizontal framing member. Both edges of cap rail shall have a smooth and radiused edge. Outdoor applications to have ultra violet stabilised, high-density polyethylene.

.7 Standard colour of cap rail shall be colour selected from manufacturer's standard colour range.

.3 Gates

.1 Access gates shall be built into standard 2440 mm (8'-0") sections and shall be 915 mm (3’-0”) wide, left or right hand swing. Gate latch shall be a single latch type, with rink side access.

.2 A flush mounted push-button latch shall be incorporated in the top sill of the cap rail on the playing surface entrance gates to the penalty boxes, player boxes and playing surface access gates. The push button shall be 3” in diameter. The push-button shall be designed to be simple to operate yet prevent accidental opening.

.3 Equipment gates shall be double gates with an 2440 mm (8’-0”) opening. Gates shall be provided with two clamping handles and one retractable pin.

.4 Each equipment gate unit shall be equipped with adjustable heavy-duty spring loaded swivel casters and adjustable tie-rod tension bars.

.5 Hinge assemblies shall be constructed of 6mm (1/4") stainless steel. The hinge pins shall be minimum 16 mm (5/8") diameter.

.4 Kickplates

.1 Kickplates shall be fabricated of 12 mm (1/2") thick nominal UV-STABILIZED HDPE colour impregnated sheets in 200 mm x 2440 mm (7 7/8" x 8'-0") segments. The kickplate shall be fastened to the bottom of the arena panel using fasteners coloured to match the kickplate. Outdoor applications to have ultra violet stabilised, high-density polyethylene.

.2 Standard colour of kickplate shall be selected by Consultant.

.5 Thresholds

.1 All access gates shall be equipped with 1” thick natural HDPE skate threshold. The width shall be enough to cover the entire width of the door openings.

.2 Machine gates shall be equipped with 1-1/2" thick natural HDPE threshold. The width shall be enough to cover the entire width of the door openings.

.3 All threshold fasteners to be counter-sunk ½" deep.

.6 Board Anchors:

.1 All arena boards shall be tightly fastened to the perimeter slab by means of zinc plated bolts or threaded rods and nuts. Anchors: Galvanized Steel or Zinc plated, permanent drilled on site anchor bolt system for securing to concrete substrate.

.7 Hardware

.1 All player and access gate hardware is to be stainless steel.

.2 Machine gate hardware is to be stainless steel

.3 Each machine gate unit shall be equipped with adjustable heavy duty spring loaded casters, with the direction of travel fixed to the arc of the door.

.4 Machine gate closure bars are to be 2" diameter solid steel and are to be a double bar sliding type.

.5 Provide a flush mounted push-button latch release in the cap rail on the ice entrance gates where shields would otherwise prevent latch operation. The push-button shall be designed to be simple to operate from both sides of the shielding (suitable for opening gates with hockey glove on hand), yet prevent accidental opening.

.6 All fasteners are to be zinc plated and are to be colour matched where necessary

2.4 FINISH

.1 All aluminum shall be clear anodized finish, Aluminum Association designation AA M12C22A31 0.0002 in. minimum coating thickness.

.2 Plating: All nuts, bolts and fasteners shall be clear zinc electroplated or cadmium plated. All door hardware, anchors and anchor bolts shall be stainless steel.

Part 3 Execution

3.1 EXAMINATION

.1 Before commencing erection and installation, examine the work of other Sections to which the work of this Section will be attached.

.2 Report immediately in writing to the Consultant, all discrepancies in accuracy and suitability, conditions that will adversely affect the installation and permanency of the work of this Section.

.3 Ensure that openings and recesses to receive the work of this Section are within acceptable tolerances. Remove dust and other loose material from openings.

3.2 PREPARATION

.1 Supply all anchors and similar items, required to be installed in the work of other Sections. Provide instruction for proper installation and arrangement.

.2 Space anchors at centres specified on manufacturer's shop drawings.

3.3 INSTALLATION

.1 General

.1 Have system manufacturer supply and install the arena board system in accordance with drawings and specifications.

.2 Ensure a complete arena system with all arenas straight and true to line and properly braced. Set work level, plumb, square and true with uniform joints.

.3 Fasten the work securely as erection progresses. Provide all units with suitable temporary braces, shores, and stays to hold them in position until permanently secured.

.2 Gates

.1 Provide quantity and location of equipment and access gates as indicated on the drawings.

3.4 ADJUSTING

.1 Upon completion of the Work of this Section, inspect, test and adjust installation.

.2 Test all operable elements and ensure easy and smooth operation.

3.5 CLEANING

.1 Keep work areas clean as work progresses. Final cleaning to be carried out as part of General Conditions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Research Council Canada (NRC)

- .1 National Building Code of Canada (2015)
- .2 National Fire Code of Canada (2015)

.2 National Fire Protection Association (NFPA)

- .1 NFPA 10 – Standard for Portable Fire Extinguishers, 2013 Edition
- .2 NFPA 17A – Standard for Wet Chemical Extinguishing Systems, 2017 Edition
- .3 NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, 2017 Edition

1.2 SCOPE OF WORK

.1 The fire protection contractor shall furnish all labour, materials, tools, appliances and equipment to entirely complete and provide for the operation of the fire protection system, as indicated in these specifications, and as shown on drawings.

1.3 WORK INCLUDED IN DIV. 21

.1 The overall intention is to provide for a finished piece of work complete in all aspects, and all items reasonably inferable as called for by the plans and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be particularly mentioned. Generally the work includes, but is not limited to the following:

- .1 Fire Protection:
  - .1 Provide and install new Portable Fire Extinguishers as per National Building Code, National Fire Code and NFPA 10.
  - .2 Provide and install Wet Chemical fire suppression system for kitchen hoods as per National Building Code, National Fire Code, NFPA 17A and NFPA 96.
  - .3 Provide any and all submissions as mentioned in Section 21 05 00 – Common Work Results for Fire Suppression and any other relevant section.
  - .4 All identification required for piping and equipment under the responsibility of this contractor shall also be the responsibility of this contractor.
  - .5 All vibration isolation equipment required for piping and equipment under the responsibility of this contractor shall also be the responsibility of this contractor.

1.4 WORK NOT INCLUDED IN DIV. 21

.1 Excavation and backfill work shall be the responsibly of the General Contractor.

.2 Any and all electrical wiring above 50V shall be the responsibility of Div. 26 unless indicated otherwise.

.3 All architectural finishes, core drilling, cutting, and patching shall be the responsibility of the general contractor.

.4 Fire alarm system and connections shall be by Div. 28.

.5 Any required trenching of floors, or removal of existing T-bar ceilings for the running of piping shall be the responsibility of the General Contractor.

.6 Firestopping of penetrations through walls and floors shall be the responsibility of the general contractor in accordance with specification section 21 05 00 – Common Work Results for Fire Suppression.

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 GENERAL PROVISION

.1 This section covers items common to all sections of Division 21 and is intended only to supplement the requirements of Division 1.

1.2 REFERENCES

.1 The installation of the fire suppression systems shall be in accordance with the drawings issued under this contract, these specifications, and:

- .1 The National Building Code of Canada 2015.
- .2 The National Fire Code of Canada 2015.
- .3 The National Plumbing Code of Canada 2015.
- .4 NFPA 10 – 2013 Standard for Portable Fire Extinguishers.
- .5 NFPA 13 – 2016, Standard for the Installation of Sprinkler Systems.
- .6 NFPA 25 – 2017, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .7 NFPA 20 – 2016, Standard for the Installation of Stationary Pumps for Fire
- .8 NFPA 96 – 2017, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .9 Underwriter's Laboratories of Canada (ULC).
- .10 Material Safety Data Sheets (MSDS)

.2 Other references:

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1-16, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)

1.3 RESPONSIBILITY FOR TRIAL USAGE

.1 Obtain written permission from Consultant to start and test permanent equipment and equipment and systems prior to acceptance by Owner.

.2 Comply with the requirements of Architect/ Consultant in connection with the use of these systems and equipment.

.3 Such use of permanent equipment and systems shall in no way prejudice the period of guarantee of all equipment and systems which shall commence upon the acceptance of the building by the Owner as substantially complete.

.4 Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, materials and instruments required for testing.

.5 Such tests shall not be construed as evidence of acceptance of any part of the contract and it is agreed and understood that no claim for damage will be made for any injury or breakage to any part or parts of the tested equipment due to the aforementioned tests.

1.4 EXAMINATION OF SITE AND DRAWINGS

.1 Examine the site and local conditions affecting the work of this contract prior to submitting tender.

.2 Examine the electrical drawings and determine that the work under this contract can be carried out without changes to the building as it is shown on these drawings.

.3 Before commencing any work, examine the work of other trades and report at once any defects or interference affecting the work of this division.

.4 Notes on the drawings are intended to form a part of this specification.

.5 The fire suppression drawings do not show all structural details of the building. Any information involving accurate dimensions of the building shall be taken from the figured dimensions on the architectural drawings or by measurements taken on site.

.6 The contractor shall make, without additional charge, any necessary changes to accommodate structural conditions as built or existing.

.7 As work progresses and before installing fixtures, fittings, or equipment which may interfere with the interior treatment or use of the building, consult with the Architect/ Consultant on the exact location of such equipment.

.8 The drawings indicate the general location and route of pipes, ducts, etc. Where required piping, etc., are not shown, or shown diagrammatically, they shall be installed to conserve head room and space.

.9 The plans do not necessarily show all valves, unions, etc. The Contractor shall not avail himself to these obvious omissions but shall install the work complete in essential details that it will function properly and so that repairs or removal of equipment can easily be accomplished.

.10 The drawings are intended to serve as a guide to the Contractor. It is the contractor's responsibility to coordinate work on-site to ensure that all trades can be installed while following these specifications and maintaining the general intent of the drawings.

.11 Bidders finding discrepancies in, or omissions from the drawings, specifications, or other documents, or having any doubts as to the intent or meaning of any part thereof, shall immediately notify the Architect/ Consultant who will send written instructions or explanations to all bidders. Neither the Architect/Consultant, nor the Owner will be responsible for oral instructions.

.12 The Architect/Consultant will supply to the contractor a copy of all the sprinkler preliminary drawings in pdf format at no cost to help him in the production of the working drawings. For any other format such as Autocad format, the contractor should expect to be charged for the additional work. Additional cost would depend on the work involved and cost would be based on an hourly rate of 85.00 $ / hr.

1.5 SITE COORDINATION

.1 Coordinate the Fire Protection work with the work of other trades to facilitate the progress of the work as a whole.

.2 Consultant has provided coordination drawings as proof of concept, however this does not alleviate the contractor's responsibility to coordinate work on-site to ensure that all trades will be able to be installed in space available.

.3 Any change in the work or schedule caused by failure to coordinate trades shall not be considered as a claim for extra compensation.

1.6 CHANGES AND EXTRAS

.1 No change to the drawings and specifications will be accepted, if not authorized in writing by the Architect/Consultant.

.2 All work carried out which does not conform to the plans and specifications shall be corrected at the Contractor's expense.

.3 The Owner reserves the right to change quantity, quality, or any kind of work or equipment described on the drawings or in the specifications without affecting the validity of the contract.

.4 Monetary adjustments required by such changes shall be accepted in writing by the Architect/Consultant before alterations are proceeded with by the Contractor.

1.7 LAWS AND ORDINANCES

.1 All work performed under this division shall comply with the requirements of the authorities having jurisdiction, including, but not limited to, the following: Provincial Department of Labour, Provincial Department of Environment, Provincial Fire Marshall, Provincial Board of Insurance Underwriters, Provincial Department of Health, Plumbing Inspector, Building Inspector, National Building Code of Canada, Local and Municipal By-Laws and Canadian Standards Association.

1.8 INSPECTIONS

.1 Consultant reserves the right to require an inspection of work prior to any part of the work which may conceal work being done. This includes but is not limited to underground inspections, open wall inspections and open ceiling inspections.

.2 Contractor shall be responsible to schedule work in a manner which shall limit the number of inspections required to one per area per phase of work (underground, open wall, open ceiling, etc.).

.3 Advise Consultant minimum 72 hours in advance for all inspections required. Provide for a minimum of 48h window where Consultant may choose to perform his inspection. This includes, but is not limited to, open ceiling, open wall, substantial, final and additional inspections as requested in following technical sections.

1.9 GUARANTEE

.1 All fire suppression work and equipment shall be guaranteed to work satisfactorily for a period of one year from the date of acceptance of substantial completion of the contract, provided any failure is not due to neglect or improper use by the Owner.

.2 Any certificate given, payment made, partial or entire use of the equipment by the Owner, shall not be construed as acceptance of defective work or improper materials.

.3 This general guarantee shall not act as a waiver of any specified guarantee for any greater length of time.

1.10 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 11 00 – General Requirements.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 01 11 00 – General Requirements.

.1 Shop drawings: submit drawings with contractor revision stamp and signed.

.2 Submit complete plans to Authority of Jurisdiction for review and approval before commencement of work.

.3 Shop drawings and product data shall show:

.1 Materials
.2 Finishes
.3 Method of anchorage
.4 Number of anchors
.5 Supports
.6 Reinforcement
.7 Assembly details
.8 Accessories
.9 Mounting arrangements.
.10 Operating and maintenance clearances. eg. access door swing spaces.

.4 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify as to current model production.
.5 Certification of compliance to applicable codes.
.6 Power and control diagrams.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 11 00 – General Requirements in accordance with ANSI/NFPA 20.

.2 Provide detailed hydraulic calculations including: summary sheet, Contractor's Material and Test Certificate for aboveground and underground piping, as well as other deliverables for incorporation into manual specified in Section 01 11 00 – Standard General Requirements, in accordance with ANSI/NFPA 13.

.3 Drawings:

.1 System layout.

.2 Electrical wiring diagrams.

.4 Field Test Reports:

.1 Preliminary tests on system.

.5 Records:

.1 As-built drawings of each system.

.1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.

.2 Submit drawings on reproducible Mylar film with title block similar to full size contract drawings.

.6 Operation and Maintenance Manuals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 11 00 – General Requirements.

.2 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground and underground piping and other documentation for incorporation into manual specified in Section 01 11 00 – General Requirements in accordance with ANSI/NFPA 13.

.3 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.

.4 Operation data to include:

.1 Operation instruction for each system and each component.

.2 Description of actions to be taken in event of equipment failure.

.3 Valves schedule and flow diagram.

.4 Colour coding chart.

.5 Maintenance data shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.6 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.11 PERMITS AND TAXES

.1 This Contractor shall apply for and pay all necessary municipal permits. All Provincial and Municipal taxes shall be included in the tendered amount.

.2 This contractor shall arrange for all inspections of work as required by the authorities.

.3 All materials and labour required to conform to any or all of the regulations imposed by the authorities having jurisdiction over the contract shall be included by the Contractor in his tender. There shall be no additional charges to the Owner.

1.12 STAGING

.1 This contractor shall supply all staging and equipment necessary for the installation of his work.

1.13 LABOUR AND WORKMANSHIP

.1 All tradesmen employed by this Contractor for this work shall be properly licensed journeymen and apprentices qualified to do work in each particular trade. The Architect/Consultant shall have the right to examine each man's credentials and order any unqualified personnel away from the project.

.2 This Contractor shall be completely responsible for the proper execution of the work as outlined in the plans and specifications. This Contractor shall assume responsibility for workmanship and material defects whether or not they are discovered by the Architect/Consultant.

1.14 DEFICIENCY LISTS

.1 The Architect/Consultant will notify this Contractor at various intervals of defective workmanship or installation deficiencies, etc. This Contractor shall not request revised or updated lists without first submitting a current detailed, item by item report on the status of all deficiencies as reported to the Contractor on a previous listing.

.2 When the Contractor notifies the Architect/ Consultant that the contract is ready for final inspection, a comprehensive deficiency listing will be prepared. If such list exceeds twenty (20) items, the contract shall not be considered ready for final inspection and the Architect/ Consultant need not to furnish the Contractor with such listing.

1.15 METRIC DESIGNATION OF NOMINAL PIPE SIZES

.1 For the purposes of this contract only, pipes and tubes shown in this specification and on accompanying drawing(s) have been given metric nominal sizes in accordance with the following table:

In.	mm	Ins.	mm	Ins.	mm	Ins.	mm
1/4	6	2 1/2	65	15	375	36	900
5/16	8	3	75	16	400	39	975

3/8	10	3 1/2	90	18	450	40	1000
1/2	12	4	100	20	500	44	1100
5/8	16	5	125	21	525	48	1200
3/4	20	6	150	22	550	52	1300
7/8	22	7	175	pl.	560	56	1400
1	25	8	200	24	600	60	1500
1 1/8	28	9	225	pl.	630	64	1600
1 1/4	32	10	250	26	650	72	1800
1 3/8	35	11	275	27	675	Then by multiples of 200 mm to 4000 mm	
1 1/2	40	pl.	280	28	700		
1 5/8	41	12	300	pl.	710		
1 3/4	44	pl.	315	30	750		
1 7/8	47	14	350	32	800		
2	50	pl.	355	33	825		

Notes:
pl. – listed in CGSB.41 – Plastic Series.

.2 It should be understood by all concerned that there is no intended physical change in the sizes of pipes, tubes, fittings, valves and screw threads. They are simply given a metric nominal designation.

.3 Pipe thread sizes will be designated as they have been in the past: e.g. 2" NPT means a two inch tapered pipe thread, to ANSI B2.1, pipe threads, specification.

1.16 METRIC SYMBOLS

.1 All metric symbols used in this specification and on the accompanying drawings are those used in National Standard of Canada, CAN3-Z234.1-79, Canadian Metric Practice Guide.

1.17 METRIC DESIGNATION OF SHEET METAL GAUGES

.1 For the purpose of this contract only, sheet metal gauges shown on this specification and on the accompanying drawing(s) are given in millimeter thicknesses in accordance with the following table of gauge equivalents:

Nominal Thickness in mm	Hot or Cold Rolled Steel	Stainless Steel	Galvanized Steel	Aluminium
0.4	28	28	30	26
0.5	26	26	28	24
0.6	24	24	26	22
0.8	22	22	22 to 24	20
1	20	20	20	18
1.2	18	18	18	16
1.5	16	16	16	14
2	14	14	14	12
2.5	12	N/A	N/A	10
3	N/A	12	12	N/A
3.5	10	10	N/A	8

4	8	N/A	N/A	6
4.5	N/A	8	N/A	N/A

.2 Metric Sheet Metal Products:

.1 The above noted table indicates the metric nomenclature which replaces the gauge numbers of those metal sheets commonly used in construction.

1.18 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Where specified elsewhere in Division 21, manufacturers to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

1.19 QUALITY ASSURANCE

.1 Quality assurance in accordance with Section 01 45 00 – Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.3 Quality assurance submittals: submit following in accordance with Section 01 11 00 – General Requirements.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.20 DELIVERY STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 11 – Cleaning.

.2 Packing, shipping, handling and unloading:

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

.3 Storage and Protection:

.1 Store materials indoors in dry location.

.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.4 Waste Management and Disposal:

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Handle and dispose of hazardous materials in accordance with regulations.

Part 2 Products

2.1 MATERIALS

.1 All materials used in this project must be purchased directly through jobbers, manufacturer's agent, wholesalers and suppliers having an established office in the Maritime representatives. By submitting a tender, this Contractor acknowledges this responsibility.

.2 All pipes & fittings shall be manufactured in Canada or the United States and bear the label ULC.

2.2 STANDARD OF ACCEPTANCE

.1 Means that item named and specified by catalogue number forms part of specification regarding performance, quality of materials and workmanship.

.2 Tender price shall be based upon materials as specified. Manufacturer's products that are not named in the specifications must receive approval from the Architect/Consultant prior to the tender closing date. See section 00 21 00 - Notice to Bidders.

.3 All designs are based on units numbered in schedules on drawings or stated as being "basis of design" in the spec. If approved equal is chosen, contractor shall be responsible for any and all modifications required to make unit fit, including but not limited to mechanical, electrical, architectural and structural modifications.

2.3 EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 21.

.2 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm high and 50 mm larger than equipment dimensions all around.

.3 Supply anchor bolts and templates for installation by other division.

2.4 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.4 Sizes: minimum 6 mm clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm above other floors.

.6 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.

2.5 FIRESTOPPING

.1 All penetrations through all fire separations (Wall and floor penetrations) are to be fire stopped.

.2 All firestopping by general contractor with the exception of mechanical firestopping as specified elsewhere in Division 21. Refer to Section 07 84 00 – Firestopping.

.3 Mechanical contractors to coordinate number, size and locations of openings with general contractor.

2.6 ESCUTCHEONS

.1 On pipes passing through walls, partitions, floors and ceilings in finished areas.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

2.7 SPECIAL TOOLS AND SPARE PARTS

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

.2 Identify spare parts containers as to contents and replacement parts number.

2.8 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: use prime coated steel.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.3 Installation is specified in applicable sections.

2.9 DIELECTRIC COUPLINGS

.1 General:

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.2 Pipes 50mm and under: isolating unions.

.3 Pipes 65mm and over: isolating flanges.

2.10 IDENTIFICATION TAGS & SIGNS

.1 Identification tags shall be red lamicoid with white letters.

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 piping and equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied Consultant.

3.2 INSTALLATION

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

3.3 PIPE INSTALLATION

.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

3.4 CUTTING AND PATCHING

.1 All cutting and patching shall be the responsibility of the general contractor. Mechanical contractor to coordinate location of openings for mechanical equipment with general contractor.

.2 If, however, cutting and patching is required to fix a defect and/or omission which is the responsibility of the Mechanical contractor, of if mechanical contractor chooses alternate routings which would increase the amount of cutting and patching, all cutting and patching costs required to cover this defect and/or omission and/or alternate routing shall be carried by the Mechanical contractor.

3.5 CONCEALMENT

.1 Unless otherwise shown or specified, all ducts and piping shall be run concealed in ceilings, walls, partitions, etc.

.2 Heating risers and water piping shall not be concealed in exterior walls without adequate thermal protection. Consultant's approval shall be required for any such piping to be concealed in exterior walls.

3.6 ELECTRICAL

.1 Electrical work to conform to Division 26 including the following:

.1 Supplier and installer responsibility is indicated on electrical drawings and related mechanical responsibility is indicated on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25. Refer to Division 26 for quality of materials and workmanship.

3.7 PREPARATION FOR FIRESTOPPING

.1 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe to move without damaging firestopping material.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

3.8 SITE TEST

.1 General:

.1 In accordance with NFPA 25, supplemented as specified.

.2 Testing witnessed by authority having jurisdiction if required.

.1 Perform flow tests, including tests of pre-action systems, as required by:

.1 Authority having jurisdiction.

.2 Applicable standards.

.3 Local building codes.

.3 Identification:

.1 Verify devices are properly labelled, identifying area served, etc.

.4 Report:

.1 In addition to reports required by NFPA 25, include the following:

.1 Copy of schematic and valve schedule.

.5 Documentation:

.1 Provide written certification to Consultant that system was installed, flushed and tested in accordance with appropriate codes, approved plans and calculations.

.2 Certificate to include:

.1 Contractors name.

.2 Contractors address.

.3 Contractors license number.

.4 List of approved materials and devices installed.

.5 Certification that system is complete and in service.

.6 Approved signage has been provided and attached as appropriate.

3.9 PAINTING

.1 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Any piping, ductwork equipment, etc, which needs to be painted as part of the contract shall be painted by the general contractor. Refer to Section 09 91 00 – Painting. The rest of this section is to serve as a guide for painter.

.4 Clean, pre-treat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.5 Apply coatings to clean, dry surfaces, using clean brushes.

.6 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.7 Provide primed surfaces with following:

.1 Piping in Finished Areas:

.1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.

.2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.

.3 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.

3.10 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1.

.1 Perform test to determine compliance with specified requirements in presence of Consultant.

.2 Test, inspect, and approve piping before covering or concealing.

3.11 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Where specified elsewhere in Division 21, manufacturers to provide demonstrations and instructions.

.5 Instruction duration time requirements as specified in appropriate sections.

3.12 TRAINING

.1 Contractor shall provide one (1) two (2) hour sessions with personnel for commissioning and training.

.2 Coordinate with fire alarm system commissioning.

3.13 COMMISSIONING

.1 All bugs relating to mechanical equipment shall be fixed during commissioning process so that commissioning can be completed in a timely fashion. All deficiencies shall be fixed at no extra cost.

.2 Contractor shall perform any and all test on their own equipment as required by manufacturer and as described in equipment’s relevant section in order to ensure that their equipment is functioning properly.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 10-2013, Standard for Portable Fire Extinguishers.

.3 Standards Council of Canada

.1 CAN/ULC-S508-M90, Standard for the Rating and Fire Testing of Fire Extinguishers and Class D Extinguishing Media.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 00 – Common Work Results for Fire-Suppression.

.2 Product Data:

.1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS MSDS - Material Safety Data Sheets.

.3 Provide shop drawings according to section 21 05 00 – Common Work Results for Fire Suppression.

.4 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 21 05 00 – Common Work Results for Fire-Suppression.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.

.1 Size: 4.5 kg, 4A:60BC unless noted otherwise.

2.2 KITCHEN EXTINGUISHERS (CLASS K)

.1 Stored pressure rechargeable type ULC labelled for K class protection.

.1 Size: 6.0 L unless noted otherwise.

2.3 ELECTRICAL FIRE EXTINGUISHERS

.1 Stored pressure rechargeable type ULC labelled for electrical fire hazards.

.1 Size: 4.5kg, 10BC unless noted otherwise.

2.4 EXTINGUISHER BRACKETS

.1 Fire extinguisher wall bracket complete with bottom support and holding clamp. As recommended by extinguisher manufacturer.

2.5 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10 and CAN/ULC-S508.

.2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

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 or mount extinguishers in cabinets or on brackets in accordance with NFPA 10.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 NFPA 17A-17, Standard for Wet Chemical Extinguishing Systems, 2002 Edition.

.2 NFPA 96-17 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American National Standards Institute/Underwriters' Laboratories Inc. (ANSI/UL)

.1 ANSI/UL 464-April 2003, Standard for Audible Signal Appliances.

.2 ANSI/UL 464 R (October 10, 2003), Standard for Audible Signal Appliances.

.3 Underwriters' Laboratories Inc. (UL)

.1 UL 21-December 2014, Standard for LP-Gas Hose.

.2 UL 252-September 2010, Standard for Compressed Gas Regulators.

.3 UL 300-May 2005, Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment.

.4 UL 569-November 2013, Standard for Pigtails and Flexible Hose Connectors for LP-Gas.

.5 UL 1254-February 2013, Standard for Pre-Engineered Dry Chemical Extinguishing System Units.

.4 Underwriters' Laboratories of Canada (ULC)

.1 Various listings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 00 – Common Work Results for Fire Protection.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for fire extinguishing systems, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide WHMIS MSDS - Material Safety Data Sheet.

.3 Provide ULC listed maintenance data for incorporation into manual specified in Section 21 05 00 – Common Work Results for Fire Protection.

.3 Shop Drawings:

.1 Provide shop drawings as specified in section 21 05 00 – Common Work Results for Fire Protection.

Part 2 Products

2.1 DESCRIPTION

.1 The Fire Protection Contractor shall supply and installed a fully functional pre-engineered Kitchen Fire Protection System designed and installed as per these specifications.

2.2 COMPONENTS

.1 ULC listed pre-engineered system.

.2 Design to NFPA 17A, to protect type I kitchen exhaust hoods (grease hoods).

.3 Design systems to UL 1254 requirements; include in operating manual the following:

- .1 Description of system operating details.
- .2 Description of fire risks to be protected.
- .3 Pipe and fitting limitations.
- .4 Nozzle limitations, including maximum dimensional and area coverage, and installation location.
- .5 Requirements for equipment maintenance.

2.3 STORAGE CONTAINERS

.1 Main bank of extinguishing agent and expellant gas.

.2 Pressure gauge on each container.

.3 Approved container mounting and retaining system.

.4 Capacity: As determined by System Designer.

.5 Caps, plugs or valves connected to pressurized cylinder must have at least four full threads of engagement.

.6 Provide means of relieving pressure when a minimum of two full threads are engaged between device and cylinder, to prevent potential injury when cylinder valve assembly is pressurized while being serviced.

2.4 PIPING AND FITTINGS

.1 To NFPA 17A.

.2 Finish: chrome plated or polished stainless steel in exposed areas.

.3 Scarf or notch bottom of siphon tubes used to transport extinguishing agent through pressure vessel and valve to distribution piping to provide for uninterrupted flow of extinguishing agent.

.4 Pressure regulators to comply with applicable requirements of UL 252.

.5 Hose assemblies used for distributing extinguishing agent to comply with applicable requirements of UL 21 and UL 569.

2.5 NOZZLES

.1 Stainless steel or non-ferrous with satin finish.

.2 Provide frangible discs or blow-off caps as indicated or specified.

2.6 FIRE DETECTION SYSTEM

.1 ULC listed, automatic, to NFPA 17A.

2.7 OPERATING DEVICES

.1 ULC listed operating system to ANSI/NFPA 17A.

.2 Provide one manual control ULC listed operating station to ANSI/NFPA 17A, located as indicated.

.3 Shut down devices in accordance with manufacturer's listing.

Part 3 Execution

3.1 GREASE HOOD FIRE SUPPRESSION SYSTEM

.1 All Commercial Grease Hood (type I hood) and their exhaust systems are to be supplied with a wet chemical extinguishing system as per requirements of NFPA 96.

.2 The following hoods and their exhaust systems shall be protected:

.1 KH-1

.3 Refer to drawings for hood and duct dimensions.

3.2 APPLICATION

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

3.3 INSTALLATION

.1 Install in accordance with ULC listing.

3.4 SITE TESTS

.1 Do site tests in accordance with Section 21 05 00 – Common Work Results for Fire Protection

.2 Test to acceptance in accordance with ANSI/NFPA 17A.

.3 Testing to be witnessed by authority having jurisdiction.

.4 Test system units for use with each type of cooking appliance referenced in manufacturer's installation instructions. Conduct tests in accordance with appropriate fire test method specified in UL 300.

3.5 RECHARGING

.1 After completion of tests, ensure each cylinder contains correct chemical and weight of extinguishing agent and expellant gas. Restore systems to normal condition.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Research Council of Canada

.1 National Plumbing Code of Canada (2015)

.2 National Building Code of Canada (2015)

1.2 SCOPE OF WORK

.1 The plumbing contractor shall furnish all labour, materials, tools, appliances and equipment to entirely complete and provide for the operation of the plumbing system, as indicated in these specifications, and as shown on drawings.

1.3 WORK INCLUDED IN DIV. 22

.1 The overall intention is to provide a finished system complete in all aspects, including all items reasonably inferable as called for by the plans and specifications and by normally accepted good practices, notwithstanding that every item required may not be specifically mentioned. The work includes, but is not limited to the following:

.1 Plumbing:

.1 Supply and install any and all pumps, equipment, piping, tanks, valves, supports and accessories for a new Domestic Water Supply System according to these specifications and the National Plumbing Code, including but not limited to:

.1 Domestic Cold Water System,

.2 Domestic Hot Water System,

.3 Include all testing as required by these specifications, the National Plumbing Code, and the authority having jurisdiction.

.4 Include all connections to plumbing fixtures and other equipment supplied by others.

.5 Provide and install for new main water entrance connected to public water services, complete with meter, backflow preventer, and accessories as shown on drawings or required by code. Provide for piping connection to civil contractor's water piping at 1500mm from building's foundation.

.2 Supply and install any and all equipment, piping, supports and accessories for a new Sanitary Drainage System, including but not limited to:

.1 Sanitary Drainage System for all plumbing fixtures.

.2 Venting system as per code for all plumbing fixtures.

.3 Condensate drains for all ventilation equipment requiring condensate drains.

.4 Include all testing as required by these specifications, the NPC, and authority having jurisdiction.

.5 Provide for piping connection to civil contractor's sanitary drainage sewer piping at 1500mm from building's foundation.

.6 Include all connections to plumbing fixtures and other equipment supplied by others.

.3 Provide and install plumbing fixtures as shown on drawings.

.4 Provide any and all documents and submissions as mentioned in Section 22 05 00 – Common Work Results for Plumbing and any other relevant section.

.5 All insulation and identification of piping and equipment installed under Div. 22 shall be the responsibility of this contractor.

.6 All vibration isolation equipment required for piping and equipment under the responsibility of this contractor shall also be the responsibility of this contractor.

.7 Commission plumbing systems according to requirements of Section 22 08 00 – Commissioning for Plumbing. Contractor shall be responsible for the commissioning of any and all equipment and/or system installed as part of his/her contract.

1.4 WORK NOT INCLUDED IN DIV. 22

.1 Excavation and backfill work shall be the responsibly of the General Contractor.

.2 Any and all electrical wiring above 50V shall be the responsibility of Div. 26.

.3 All architectural finishes (including painting), core drilling, cutting, and patching shall be the responsibility of the general contractor, in accordance with section 22 05 00 – Common Work Results for Plumbing.

.4 Any required trenching of floors, or removal of existing T-bar ceilings for the running of piping shall be the responsibility of the General Contractor.

.5 Firestoping of penetrations through walls and floors shall be the responsibility of the general contractor in accordance with section 22 05 00 – Common Work Results for Plumbing.

.6 Roof curb for penetrations through roof shall be by architectural.

.7 See plumbing schedule on drawings for list of plumbing equipment supplied by others.

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 GENERAL PROVISION

.1 This section covers items common to all sections of Division 22 and is intended only to supplement the requirements of Division 1.

1.2 DESCRIPTION OF WORK

.1 Work under this division covers all labour, materials and equipment required for installing and placing in operation the mechanical systems as specified herein and as shown on the drawings.

1.3 RESPONSIBILITY FOR TRIAL USAGE

.1 Obtain written permission from Consultant to start and test permanent equipment and equipment and systems prior to acceptance by Owner.

.2 Comply with the requirements of Architect/Consultant in connection with the use of these systems and equipment.

.3 Such use of permanent equipment and systems shall in no way prejudice the period of guarantee of all equipment and systems which shall commence upon the acceptance of the building by the Owner as substantially complete.

.4 Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, materials and instruments required for testing.

.5 Such tests shall not be construed as evidence of acceptance of any part of the contract and it is agreed and understood that no claim for damage will be made for any injury or breakage to any part or parts of the tested equipment due to the aforementioned tests.

1.4 EXAMINTATION OF SITE AND DRAWINGS

.1 Examine the site and local conditions affecting the work of this contract prior to submitting tender.

.2 Before commencing any work, examine the work of other trades and report at once any defects or interference affecting the work of this division.

.3 Notes on the drawings are intended to form a part of this specification.

.4 The mechanical drawings do not show all structural details of the building. Any information involving accurate dimensions of the building shall be taken from the figured dimensions on the architectural drawings or by measurements taken on site.

.5 The contractor shall make, without additional charge, any necessary changes to accommodate structural conditions as built or existing.

.6 As work progresses and before installing fixtures, fittings, or equipment which may interfere with the interior treatment or use of the building, consult with the Architect/ Consultant on the exact location of such equipment.

.7 The drawings indicate the general location and route of pipes, ducts, etc. Where required piping, etc., are not shown, or shown diagrammatically, they shall be installed to conserve head room and space.

.8 The plans do not necessarily show all valves, unions, etc. The Contractor shall not avail himself to these obvious omissions but shall install the work complete in essential details that it will function properly and so that repairs or removal of equipment can easily be accomplished.

.9 The drawings are intended to serve as a guide to the Contractor. It is the contractor's responsibility to coordinate work on-site to ensure that all trades can be installed while following these specifications and maintaining the general intent of the drawings.

.10 Bidders finding discrepancies in, or omissions from the drawings, specifications, or other documents, or having any doubts as to the intent or meaning of any part thereof, shall immediately notify the Consultant who will send written instructions or explanations to all bidders. Neither the Consultant, or the Owner will be responsible for oral instructions.

1.5 SITE COORDINATION

.1 Coordinate the Plumbing work with the work of other trades to facilitate the progress of the work as a whole.

.2 Consultant has provided coordinated drawings as proof of concept, however this does not alleviate the contractor's responsibility to coordinate work on-site to ensure that all trades will be able to be installed in space available.

.3 Any change in the work or schedule caused by failure to coordinate trades shall not be considered as a claim for extra compensation.

1.6 CHANGES AND EXTRAS

.1 No change to the drawings and specifications will be accepted, if not authorized in writing by the Architect/Consultant.

.2 All work carried out which does not conform to the plans and specifications shall be corrected at the Contractor's expense.

.3 The Owner reserves the right to change quantity, quality, or any kind of work or equipment described on the drawings or in the specifications without affecting the validity of the contract

.4 Monetary adjustments required by such changes shall be accepted in writing by the Architect/Consultant before alterations are proceeded with by the Contractor.

1.7 LAWS AND ORDINANCES

.1 All work performed under this division shall comply with the requirements of the authorities having jurisdiction, including, but not limited to, the following: Provincial Department of Labour, Provincial Department of Environment, Provincial Fire Marshall, Provincial Board of Insurance Underwriters, Provincial Department of Health, Plumbing Inspector, Building Inspector, National Building Code of Canada, Local and Municipal By-Laws and Canadian Standards Association.

1.8 INSPECTIONS

.1 Consultant reserves the right to require an inspection of work prior to any part of the work which may conceal work being done. This includes but is not limited to underground inspections, open wall inspections and open ceiling inspections.

.2 Contractor shall be responsible to schedule work in a manner which shall limit the number of inspections required to one per area per phase of work (underground, open wall, open ceiling, etc.).

.3 Advise Consultant minimum 72 hours in advance for all inspections required. Provide for a minimum of 48h window where Consultant may choose to perform his inspection. This includes, but is not limited to, open ceiling, open wall, substantial, final and additional inspections as requested in following technical sections.

1.9 GUARANTEE

.1 All mechanical work and equipment shall be guaranteed to work satisfactorily for a period of one year from the date of acceptance of substantial completion of the contract, provided any failure is not due to neglect or improper use by the Owner.

.2 Any certificate given, payment made, partial or entire use of the equipment by the Owner, shall not be construed as acceptance of defective work or improper materials.

.3 This general guarantee shall not act as a waiver of any specified guarantee for any greater length of time.

1.10 SUBMITTALS

.1 Submittals: in accordance with Section 01 11 00 – General Requirements.

.2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.6 Indicate section number and paragraph of the item.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 11 00 – General Requirements.

.2 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 22 05 93 - Testing, Adjusting and Balancing for Plumbing.

.6 Approvals:

.1 Submit 3 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.

.2 Make changes as required and re-submit as directed by Consultant.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to

existing mechanical systems, control systems and low voltage control wiring.

.2 Use different colour waterproof ink for each service.

.3 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for plumbing, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Consultant for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for plumbing using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.11 PERMITS AND TAXES

.1 This Contractor shall apply for and pay all necessary municipal permits. All Provincial and Municipal taxes shall be included in the tendered amount.

.2 Contractor shall arrange for all inspections of work by these authorities.

.3 All materials and labour required to conform to any or all of the regulations imposed by the authorities having jurisdiction over the contract shall be included by the Contractor in his tender. There shall be no additional charges to the Owner.

1.12 STAGING

.1 This contractor shall supply all staging and equipment necessary for the installation of his work.

1.13 LABOUR AND WORKMANSHIP

.1 All tradesmen employed by this Contractor for this work shall be properly licensed journeymen and apprentices qualified to do work in each particular trade. The Architect/Consultant shall have the right to examine each man's credentials and order any unqualified personnel away from the project.

.2 This Contractor shall be completely responsible for the proper execution of the work as outlined in the plans and specifications. This Contractor shall assume responsibility for workmanship and material defects whether or not they are discovered by the Architect/Consultant.

1.14 DEFFICIENCY LISTS

.1 The Architect/Consultant will notify this Contractor at various intervals of defective workmanship or installation deficiencies, etc. This Contractor shall not request revised or updated lists without first submitting a current detailed, item by item report on the status of all deficiencies as reported to the Contractor on a previous listing.

.2 When the Contractor notifies the Architect/ Consultant that the contract is ready for final inspection, a comprehensive deficiency listing will be prepared. If such list exceeds twenty (20) items, the contract shall not be considered ready for final inspection and the Architect/ Consultant need to furnish the Contractor with such listing.

1.15 METRIC DESIGNATION OF NOMINAL PIPE SIZES

.1 For the purposes of this contract only, pipes and tubes shown in this specification and on accompanying drawing(s) have been given metric nominal sizes in accordance with the following table:

In.	mm	Ins.	mm	Ins.	mm	Ins.	mm
1/4	6	2 1/2	65	15	375	36	900
5/16	8	3	75	16	400	39	975
3/8	10	3 1/2	90	18	450	40	1000
1/2	12	4	100	20	500	44	1100
5/8	16	5	125	21	525	48	1200
3/4	20	6	150	22	550	52	1300
7/8	22	7	175	pl.	560	56	1400
1	25	8	200	24	600	60	1500
1 1/8	28	9	225	pl.	630	64	1600
1 1/4	32	10	250	26	650	72	1800
1 3/8	35	11	275	27	675	Then by multiples of 200 mm to 4000 mm	
1 1/2	40	pl.	280	28	700		
1 5/8	41	12	300	pl.	710		
1 3/4	44	pl.	315	30	750		
1 7/8	47	14	350	32	800		
2	50	pl.	355	33	825		

Notes:
pl. – listed in CGSB.41 – Plastic Series.

.2 It should be understood by all concerned that there is no intended physical change in the sizes of pipes, tubes, fittings, valves and screw threads. They are simply given a metric nominal designation.

1.16 METRIC SYMBOLS

.1 All metric symbols used in this specification and on the accompanying drawings are those used in National Standard of Canada, CAN3-Z234.1-79, Canadian Metric Practice Guide.

1.17 METRIC DESIGNATION OF SHEET METAL GAUGES

.1 For the purpose of this contract only, sheet metal gauges shown on this specification and on the accompanying drawing(s) are given in millimeter thicknesses in accordance with the following table of gauge equivalents:

Nominal Thickness in mm	Hot or Cold Rolled Steel	Stainless Steel	Galvanized Steel	Aluminium
0.4	28	28	30	26
0.5	26	26	28	24
0.6	24	24	26	22
0.8	22	22	22 to 24	20
1	20	20	20	18
1.2	18	18	18	16
1.5	16	16	16	14
2	14	14	14	12
2.5	12	N/A	N/A	10
3	N/A	12	12	N/A
3.5	10	10	N/A	8
4	8	N/A	N/A	6
4.5	N/A	8	N/A	N/A

1.18 QUALITY ASSURANCE

.1 Quality assurance in accordance with Section 01 45 00 – Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 35 29.06 – Health and Safety Requirements.

1.19 DELIVERY, STORAGE AND HANDLING

.1 Construction/Demolition waste management and disposal: Separate waste materials for reuse and recycling in accordance with Section 01 74 11 – Cleaning.

1.20 MAINTENANCE

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 11 00 – General Requirements.

Part 2 Products

2.1 MATERIALS

.1 All materials used in this project must be purchased directly through jobbers, manufacturers' agent, wholesalers and suppliers having an established office in the Maritime Provinces and purchased through Maritime representatives. By submitting a tender, this contractor acknowledges this responsibility.

2.2 STANDARD OF ACCEPTANCE

.1 Means that item named and specified by catalogue number forms part of specification regarding performance, quality of materials and workmanship.

.2 Tender price shall be based upon materials as specified. Manufacturer's products that are not named in the specifications must receive approval from the Consultant prior to the tender closing date. See section 00 21 00 – Notice to Tender.

.3 All designs are based on units numbered in schedules on drawings or stated as being "basis of design" in the spec. If approved equal is chosen, contractor shall be responsible for any and all modifications required to make unit fit, including but not limited to mechanical, electrical, architectural and structural modifications.

2.3 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 General:

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

.3 Motors:

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 1/2 HP: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, voltage and number of phases as indicated elsewhere.

.4 Motors 2 HP and larger for Variable Frequency Drive application:

.1 Inverter duty, with internal or external maintenance-free Shaft Grounding Bearing Protection Ring.

.5 Temporary Motors:

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Consultant for temporary use. Work will only be accepted when specified motor is installed.

2.4 EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 22.

.2 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm high and 50 mm larger than equipment dimensions all around.

.3 Supply anchor bolts and templates for installation by other division.

2.5 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

- .1 Through foundation walls.
- .2 Where sleeve extends above finished floor.

.4 Sizes: minimum 6 mm clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm above other floors.

.6 Fill voids around pipes:

- .1 Caulk between sleeve and pipe in foundation walls, exterior walls and below grade floors with waterproof fire retardant non-hardening mastic.
- .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
- .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
- .4 Fill future-use sleeves with lime plaster or other easily removable filler.
- .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.
- .6 Where sleeves go through exterior walls, pipes shall be further sealed with “Fernco” type reducer flexible coupling to be mechanically sealed around both sleeve and pipe. Sleeve to be elongated on the exterior side accordingly.

.7 In core-drilled penetrations, sleeves can be omitted if core surface is smooth and free of any jagged edges. All other requirements shall apply.

2.6 FIRESTOPPING

.1 All penetrations through all fire separations (Wall and floor penetrations) are to be fire stopped.

.2 All firestopping by general contractor with the exception of combustible piping firestopping. Refer to Section 07 84 00 – Firestopping.

.3 Intumescent action fire stop with restraining collar for firestopping of all combustible piping penetrating fire separations.

- .1 Fire rating equal to fire separation. Refer to Architectural drawings for ratings.
- .2 Once-piece construction with anchoring system to secure the device to substrate.
- .3 Acceptable material: 3M Fire Barrier Ultra Plastic Pipe Devices or approved equal.

.4 Mechanical contractors to coordinate number, size and locations of openings with general contractor.

2.7 ESCUTCHEONS

.1 On pipes passing through walls, partitions, floors and ceilings in finished areas.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

2.8 SPECIAL TOOLS AND SPARE PARTS

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

.2 Identify spare parts containers as to contents and replacement parts number.

2.9 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: use prime coated steel.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

2.10 DIELECTRIC COUPLINGS

.1 General:

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.2 Pipes 50 mm and under: isolating unions.

.3 Pipes 65 mm and over: isolating flanges.

2.11 DRAIN VALVES

.1 Locate at low points and at section isolating valves unless otherwise specified.

.2 Minimum 20 mm unless otherwise specified: bronze, with hose end male thread and complete with cap and chain. Refer to specifications in relevant sections.

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 piping installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

.3 Equipment drains: pipe to floor drains.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

.5 Provide accessible means for lubricating equipment including permanent lubricated bearings.

.6 A minimum clearance of 2.2 m shall be maintained unless otherwise stated or impossible to achieve. Where headroom will be less than 2.0 m from the finished floor, pipe or duct runs shall be approved by the Architect/Consultant.

3.3 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

.2 protect all equipment, piping, fixtures, ductwork, etc. throughout the construction period and assume responsibility for the same.

3.4 CUTTING AND PATCHING

.1 Cutting and patching shall be the responsibility of the general contractor. Mechanical contractor to coordinate location of openings for mechanical equipment with general contractor.

.2 Core drilling for mechanical equipment and piping shall be by general contractor. Refer to section 03 82 13 – Concrete Core Drilling and Sawing. Mechanical contractor to coordinate location of openings for mechanical equipment and piping with general contractor.

.3 If, however, cutting and patching is required to fix a defect and/or omission which is the responsibility of the Mechanical contractor, of if mechanical contractor chooses alternate routings which would increase the amount of cutting and patching, all cutting and patching costs required to cover this defect and/or omission and/or alternate routing shall be carried by the Mechanical contractor.

3.5 CONCEALMENT

.1 Unless otherwise shown or specified, all ducts and piping shall be run concealed in ceilings, walls, partitions, etc. Heating risers and water piping shall not be concealed in exterior walls without adequate thermal protection.

3.6 ELECTRICAL

.1 Electrical work to conform to Division 26 including the following:

.1 Supplier and installer responsibility is indicated on electrical drawings and related mechanical responsibility is indicated on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25. Refer to Division 26 for quality of materials and workmanship.

3.7 PREPARATION FOR FIRESTOPPING

.1 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe to move without damaging firestopping material.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

3.8 TESTS

.1 Give 48 h written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Consultant.

.3 Conduct tests in presence of Consultant.

.4 Bear costs including retesting and making good.

.5 Piping:

.1 General: maintain test pressure without loss for 4 h unless otherwise specified.

.2 Test drainage, waste and vent piping to National Building Code and authorities having jurisdiction.

.3 Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.

.6 Equipment: test as specified in relevant sections.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

3.9 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

.4 Any piping, ductwork equipment, etc, which needs to be painted as part of the contract shall be painted by the general contractor. It is the responsibility of both this contractor and the general contractor to coordinate the list of equipment to be painted prior to tender closing.

.5 Refer to section 09 91 00 – Painting.

3.10 CLEANING

.1 Clean interior and exterior of all systems including strainers.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters.

3.11 COMMISSIONING

.1 Refer to section 22 08 00 – Commissioning for Plumbing.

3.12 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as required as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Consultant will record these demonstrations on video tape as required for future reference.

.6 Where specified elsewhere in Division 22, manufacturers to provide demonstrations and instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-16, Power Piping.

.2 ASTM International

.1 ASTM A125-1996(2013), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation.

.4 Underwriter's Laboratories of Canada (ULC)

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.3 OPERATIONS AND MAINTENANCE DATA

.1 Provide operations and maintenance data for incorporation into manual specified in Section 22 05 00 – Common Work Results for Plumbing.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 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 B31.1 or MSS SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 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.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.3 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.4 PIPE HANGERS

.1 All PEX piping shall be installed with supports straps installed as per manufacturer’s instructions such as Uponor PEX-a pipe supports or approved equal.

.2 Finishes:

.1 Pipe hangers and supports: galvanized or painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated.

.3 Upper attachments to wooded ceiling:

.1 Malleable iron ceiling flange, threaded rod.

.1 Acceptable material: Anvil fig. 128R or approved equal.

.4 Upper attachments to side wooded beam:

.1 Malleable iron, L shaped bracket. To MSS-SP-69, type 34, ULC listed.

.1 Acceptable material: Anvil fig. 202 or approved equal.

.5 Upper attachments to bottom of wooded beam:

.1 Screwed-in rod support, UL/FM and NFPA approved, 1760# pullout (Fir).

.1 Acceptable material: Sammy model GST-20 or approved equal.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.4 Cut off excess rods at jam nut.

.5 Acceptable Material: Anvil fig. 146 or approved equal.

2.5 INSULATION PROTECTION SHIELDS

.1 Contractors shall install pre-fabricated plastic insulation shields.

.1 Pre-fabricated plastic insulation shield:

.1 Insulated hot and cold piping:

.1 Pre-fabricated plastic insulation shield build from polypropylene copolymer, UV resistant, for operating temperatures of -40°C to 81°C, paintable, with non-adhesive surface for linear expansion of thermal insulation, ULC listed.

.2 Fire and smoke ratings in accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

.3 Shield shall be pre-fabricated with attachment system for connection to support.

.4 Acceptable material: Insuguard or approved equal.

2.6 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

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 Provide supplementary structural steelwork where structural bearings to not exist or where concrete inserts are not in correct locations.

.2 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.3 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.1 PEX Piping: maximum spacing = 800mm

.2 Within 300 mm of each elbow and on both sides of every mechanical joint.

.1 In the case of mechanical joints for drainage piping, one double-hook hanger that supports pipe on both sides of the joint is acceptable.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Cut off excess rods at jam nut.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Product data to include paint colour chips, other products specified in this section.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufactures products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.3 ENGRAVED NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	Sizes (mm)	No. of Lines	Height of Letters

			(mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Equipment in Mechanical Rooms: use size # 9.

.2 Valves in ceiling space, identification on ceiling: use size #4.

.5 Identify mechanical shut-off valves hidden in ceiling space with engraved nameplate installed on t-bar or gypsum ceiling underneath valve.

.1 Wording on nameplates and labels to be approved by Building Operators prior to manufacture.

.2 Content:

.1 Domestic Water Valves:

.1 **EFD, ECD** (as applicable)**: _____** (rooms served by valves).

2.4 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Consultant.

2.5 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Propane gas: to CSA/CGA B149.1.

2.6 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.3 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.4 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.5 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.6 Colours and Legends:

.1 All pipes on project are to be identified. Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Domestic Hot Water Supply	Green	DHW
Domestic Cold Water Supply	Green	DCW
Sanitary Drainage	Green	SAN
Plumbing Vent	Green	SAN.VENT

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 LANGUAGE

.1 Identification to be in **English**

.2 Use one nameplate and label for both language.

Part 3 Execution

3.1 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 TIMING

.1 Provide identification only after painting has been completed.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 7 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52MA-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB 51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

.3 Thermal Insulation Association of Canada (TIAC)

.1 Mechanical Insulation Best Practice Guide

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM C533-13, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.4 ASTM C547-15, Standard Specification for Mineral Fiber Pipe Insulation.

.5 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.6 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.7 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-2016

1.2 SHOP DRAWINGS PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 22 05 00 – Common Work Results for Plumbing.

1.3 SAMPLES SUBMITTALS

.1 Submit samples in accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.1 Mount sample on 12 mm plywood board.

.2 Affix typewritten label beneath sample indicating service.

1.4 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.5 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24^{o}C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code C-2: Mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C553, type I.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.056 W/m*K @ 38 °C (0.39 Btu-in./h-ft2-°F @ 100 °F) (to ASTM C553).

2.3 CEMENT

.1 Thermal insulating and finish

.1 To ASTM C449/C449M.

.2 Hydraulic setting or air drying on mineral wool, to ASTM C 449.

2.4 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CGSB 51.53 with pre-formed shapes as required.

.2 Colours: white or as indicated.

.3 Minimum service temperatures: -20 C.

.4 Maximum service temperature: 65 C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: 0.5 mm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:

.1 Outdoor: UV rated material at least 0.5mm thick.

.9 Covering adhesive: Compatible with insulation.

.2 Canvas:

.1 220 and 120 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

.3 Stainless steel:

.1 Type: 304.

.2 Thickness: 0.25 mm.

.3 Finish: Stucco embossed.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 INSULATION SECUREMENTS

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.6 Facing: 25 mm galvanized steel hexagonal wire mesh on one face of insulation with expanded metal lath on other face.

.7 Fasteners: 4 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.8 OUTDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

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 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards

.1 Hot equipment: To TIAC code 1503-H.

.1 Apply insulation block, board segments or pipe and tank insulation and secure firmly with mechanical fastenings, wire or banding. Insulation shall be fitted neatly to all contours without voids.

.2 Cold equipment: to TIAC code 1503-C.

.1 For this application use either insulation with an integral vapour retarder or field apply a vapour retarder treatment.

.2 Apply insulation block board segments or pipe and tank insulation and secure firmly with mechanical fasteners, wire or banding.

.3 All openings, joints and seams shall be sealed with self adhesive vapour retardant tape. Insulation shall be fitted neatly to all contours without voids.

.4 Elastomeric Insulation: to remain dry at all times. Overlaps to be to manufacturers instructions. Joints to be tight and sealed properly.

.2 Elastomeric Insulation: to remain dry at all times. Overlaps to be to manufacturers instructions. Joints to be tight and sealed properly.

.3 Provide vapour retarder as recommended by manufacturer.

.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.7 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At unions at equipment.

.2 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

3.5 EQUIPMENT INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges & fittings unless otherwise specified.

.1 Thickness:

.1 As per piping requirements

.2 Cold equipment:

.1 TIAC C-2 faced with vapour retardant jacket and with wire or bands and 13 mm cement preceded by one layer of reinforcing mesh.

.2 Thicknesses (except for pre-insulated equipment):

.1 Plumbing Specialties 25 mm

.3 Finishes:

.1 Definitions:

.1 TIAC code **CEF/2** for indoors:

.1 Secure canvas using fire resistive lagging coating and finish with one (1) coat of fire resistive lagging coating.

.2 Alternatively, finish with a layer of PVC jacket with all joints and seams sealed.

.2 Schedule

.1 TIAC code C-2 on cold equipment in mechanical rooms: TIAC code CEF/2 with PVC jacket.

.2 TIAC code C-2 on hot equipment in mechanical rooms: TIAC code CEF/2 with PVC jacket.

.3 Equipment in finished area to be painted: TIAC code CEF/2 with canvas jacket.

.4 Equipment elsewhere: TIAC code CEF/2 with 13 mm PVC jacket.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-16, Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].

.2 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533-13, Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-15, Mineral Fiber Pipe Insulation.

.7 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702-14, Thermal Insulation, Mineral Fibre, for Buildings

.4 CAN/ULC-S702.2-15, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 22 05 00 – Common Work Results for Plumbing.

1.3 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Store at temperatures and conditions required by manufacturer.

1.5 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.2 TIAC codes:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at specified mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547, type I, Grade A.

.2 Maximum "k" factor: 0.036 W/m*K @ 38 °C (0.25 Btu-in./h-ft2-°F @ 100 °F) (to ASTM C547).

.4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547, type I, Grade A.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.036 W/m*K @ 38 °C (0.25 Btu-in./h-ft2-°F @ 100 °F) (to ASTM C547).

2.4 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS AND FINISHS

.1 Polyvinyl Chloride (PVC) jacket:

.1 One-piece moulded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.

.2 Colours: white or as indicated.

.3 Minimum service temperatures: -20 C.

.4 Maximum service temperature: 65 C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: 0.5 mm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special Requirements:

.1 For outdoor use: use UV protecting material, minimum 0.5 mm thick.

.9 Lagging adhesive: compatible with insulation.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, and free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.1 Hot application (15 °C to 315 °C): TIAC code **1501-H**

.1 Piping: Pipe covering without integral jacket shall be held in place with insulation fastening at not less than 300 mm centres. Pipe insulation with integral jacket shall be held in place by stapling the flap on 75 mm centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.

.2 Screwed or welded fittings: Insulate fittings with sections of the pipe insulation mitered to fit tightly, or with tightly placed flexible insulation covered with reinforcing membrane stapled in place. Alternately insulate fittings with tightly placed flexible insulation and apply PVC fitting covers.

.3 Valves, Strainers: Insulate valve bodies and strainers with fitted pipe insulation segments, or mitered blocks all to thickness of the adjacent pipe insulation. Drains, blowoff plugs and caps shall be left uncovered. Alternately insulate with tightly placed flexible insulation and apply PVC fitting covers.

.4 Flanged and grooved fittings: Insulate with oversized pipe covering or mitered blocks to the thickness of the adjacent pipe covering. Alternately insulate with tightly placed flexible insulation and apply PVC fitting covers.

.5 Insulation Termination Points: Terminate insulation 75mm from fittings to provide working clearance and bevel insulation at 45° angle.

.2 Cold application (temperatures 4 °C to 15 °C): TIAC code **1501-C**

.1 Piping: Apply pipe insulation with integral vapour retarder jacket to piping and hold in place by securing the jacket flap. Seal all flaps and butt strips with vapour retarder adhesive or alternately secure with staples on 75 mm centers and cover with vapour retarder tape. Pipe insulation with integral self-sealing vapour retarder jacket will not require additional fastening.

.2 Screwed or welded fittings: Insulate fittings with section of the pipe insulation mitered to fit tightly. All seams shall be sealed using vapour retarder tape.

.3 Valves, Strainers: Insulate valve bodies, bonnets and strainers with fitted pipe insulation or mitered blocks all to thickness of adjacent pipe insulation, then seal all seams of vapour retarder with vapour retarder tape.

.4 Flanged and grooved fittings: Insulate with oversized pipe insulation or mitered blocks to the thickness of the adjacent pipe insulation, then seal all seams of vapour retarder jacket with vapour retarder tape.

.3 Cold application (any temperature below 15 °C): TIAC code **1501-CA**

.1 Flexible foamed elastomeric or closed cell insulation may be used in accordance with the manufacturer's instructions.

.2 Apply materials in accordance with manufacturer’s instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: unions at equipment.

.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: as per piping.

3.4 PIPING INSULATION SCHEDULES

.1 Scope of Work: Work shall include the following:

.1 All piping as per table herein.

.2 Includes valves, valve bonnets, strainers, flanges, unions and fittings unless otherwise specified.

.3 TIAC Code: A-1.

.1 Securements: SS Bands @ 300 mm °C.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.4 TIAC Code: A-3.

.1 Securements: SS Bands @ 300 mm °C.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.5 Thickness of insulation to be as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.6 Thickness of insulation to be as listed in following table.

Application	Temp. (°C)	Material TIAC Code	Pipe sizes (mm) and insulation thickness (mm)					
			Run Out**	Up to 25 mm	32 mm to 50 mm	65 mm to 100 mm	125 mm to 150 mm	& over
Domestic Hot Water*	60 to 82	A-1	25	25	25	38	38	38
P-Traps (Exposed on Barrier-Free Lavatories)	43 to 60	A-1	25	25	25	25	25	25
Domestic Cold Water*	4 to 12	A-3	25	25	25	25	25	25
Non-Potable Water	4 to 12	A-3	25	25	25	25	25	25
Notes: * Stops and supplies for plumbing fixtures do not require insulation with the exception of stops and supplies for barrier-free lavatories which needs insulation as per requirements of piping. ** Run-outs to individual units and equipment not exceeding 4000 mm long								

.1 Finishes:

.1 Definitions:

.1 TIAC code **CPF/2**, for indoor applications

.1 Leave insulation as is, with no additional finish

.2 TIAC code **CPF/4**, for indoor or outdoor application

.1 Over the pipe insulation apply PVC jacketing using necessary fastenings on approximately 300mm centers, or bond using an adhesive recommended by the manufacturer to provide continuous seal. Overlap each section a minimum 75 mm. Cover longitudinal and circumferential joints with finishing tape neatly applied.

.2 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges if specified) apply PVC jacket or preformed PVC fitting covers to provide a complete jacket system. Secure with appropriate fastenings and jacket finishing tape

.2 Schedule

Location	TIAC Material Code	TIAC Finish Code
Mechanical Space	A-3	CPF/4 with PVC jacket
	A-1 (hot water)	CPF/4 with PVC jacket
Finished area to be painted	Any	CPF/4 with PVC jacket
Concealed indoors	Any	CPF/2

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

1.2 GENERAL

.1 Commissioning is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Commissioning is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff.

.2 Contractor assists in Commissioning process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Commissioning activities supplement field quality and testing procedures described in relevant technical sections.

.2 Commissioning is conducted in concert with activities performed during stage of project delivery. Commissioning identifies issues in Planning and Design stages which are addressed during Construction and Commissioning stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Commissioning activities includes transfer of critical knowledge to facility operational personnel.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Commissioning, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Consultant, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Consultant before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.6 SUBMITTALS

.1 Submittals: in accordance with Section 22 05 00 – Common Work Results for plumbing.

1.7 COMMISSIONING SCHEDULE

.1 Provide adequate time for Commissioning activities prescribed in technical sections and commissioning sections including:

.1 Approval of Commissioning reports.
.2 Verification of reported results.
.3 Repairs, retesting, re-commissioning, re-verification.

1.8 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.9 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Commissioning:

.1 Under actual or accepted simulated operating conditions, over entire operating range, in all modes.
.2 On independent systems and interacting systems.

.2 Commissioning procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.10 COMPLETION OF COMMISSIONING

.1 Upon completion of Commissioning leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in commissioning specifications, complete commissioning prior to issuance of Interim Certificate of Completion.

.3 Commissioning to be considered complete when contract Commissioning deliverables have been submitted and accepted by Consultant.

1.11 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.12 OCCUPANCY

.1 Cooperate fully with Owner during stages of acceptance and occupancy of facility.

1.13 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Consultant will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

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 MINIMUM REQUIREMENTS

.1 Procedures proposed herein are minimum verification requirements only and do not absolve manufacturer and/or contractor of any obligations regarding quality of work and warranty of their equipment or any other obligation specified elsewhere.

3.3 PERFORMANCE VERIRFICATION

.1 When cleaning is completed and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in Division 22.

.2 Check for proper operation of water hammer arrestors. Run greatest volume outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor. Repeat for each outlet and flush valve.

.3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

3.4 POTABLE WATER SYSTEMS

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Bring DHW storage tanks up to design temperature slowly.

.4 Monitor piping DHW and DHWR piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

.5 Commissioning of Specialties:

.1 Water hammer arrestors:

.1 Verify accessibility.

.2 Backflow preventers, vacuum breakers:

.1 Verify installation of correct type to suit application.

.2 Adjust as necessary to ensure proper operation.

.3 Verify visibility of discharge.

.3 Trap seal primers:

.1 Verify operation.

.2 Adjust flow rate to suit site conditions.

.4 Pipeline strainers:

.1 Verify accessibility of basket.

.2 Clean out during commissioning until system clean.

.6 Flushing and cleaning:

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

.1 Disinfection of piping can be done with either chlorination or hot water circulation, except for the following portions of the piping which shall be done with hot water circulation only:

.1 Branch piping to RO systems

.2 For chlorination, use chlorinated water (25 mg/L). Retain chlorinated water in piping for 24h. Flush system after 24h period.

.3 For hot water circulation, piping shall be supplied with hot water of a temperature of at least 70 °C for at least 30 minutes.

.2 Flush entire system for 8 hours. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean. Let system flush for additional 2 hours, then draw off another sample for testing.

.3 Upon completion, provide laboratory test reports on water quality for Consultant approval.

.7 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 TAB HWC in accordance with Section 22 05 93 - Testing, Adjusting and Balancing for Plumbing.

.3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.4 Sterilize DHW and DHWR systems for Legionella control.

.5 Verify performance of temperature controls.

.6 Verify compliance with safety and health requirements.

.7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.8 Confirm function/sensitivity of all fixtures within design range.

.8 Reports:

.1 In accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

.3 Provide start-up reports for all specialty drainage equipment such as neutralization tanks.

3.5 SANITARY DRAINAGE SYSTEMS

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Floor drains:

.1 Verify proper operation of trap primer, flushing features.

.2 Verify security and removability of strainers.

.3 Prime, using trap primers.

.4 Clean out baskets.

.2 Cleanouts:

.1 Verify covers are gastight, secure and easily removable.

.2 Ensure accessible and that access doors are correctly located.

.3 Open, cover with linseed oil and re-seal.

.4 Verify that cleanout rods can probe as far as the next cleanout, at least.

.3 Traps:

.1 Test to ensure traps are fully and permanently primed.

3.6 FIXTURES

.1 Conform to water conservation requirements specified this section.

.2 Adjustments.

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.4 Adjust urinal flush timing mechanisms.

.5 Adjust water cooler, drinking fountain flow stream to ensure no spillage.

.6 Automatic flush valves for WC's and urinals: set controls to prevent unnecessary flush cycles during silent hours.

.3 Checks.

.1 Water closets, urinals: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Refrigerated water coolers: operation, temperature settings.

.4 Thermostatic controls.

.1 Verify temperature settings, operation of control, limit and safety controls.

.5 Training:

.1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.

.6 Certificates:

.1 Upon completion, furnish certificates confirming satisfactory installation and performance.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ASME B31.9-14, Building Services Piping.

.2 ASTM International Inc.

.1 ASTM A182/A 182M-16, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

.2 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A351/A351M-16, Castings, Austenitic, for Pressure Containing Parts.

.4 ASTM F876-15, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

.5 ASTM F877-11, Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System.

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI/AWWA C110/A21.11-12, American National Standard for Ductile Iron and Gray Iron Fittings for Water.

.2 ANSI/AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.3 ANSI/AWWA C151/A21.51-09, Ductile Iron Pipe, Centrifugally Cast, for Water.

.4 AWWA C904-06, Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service

.5 Canadian Standards Association (CSA International)

.1 CSA B137.5-13, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.2 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

.3 CSA B51-14, Boiler, Pressure Vessel and Pressure Piping Code.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-07, Fire Endurance Tests of Buildings Construction and Materials.

.2 CAN/ULC S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.3 CAN/ULC S115-11, Standard Method of Fire Tests of Firestop.

.7 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.9 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-17, Butterfly Valves.
.2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.10 National Research Council (NRC)/Institute for Research in Construction

.1 NRCC 38728, National Plumbing Code of Canada (NPC) - 2015.

.11 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

.12 NSF International

.1 NSF/ANSI 61-2016 – Drinking Water System Components – Health Effects
.2 NSF/ANSI 372-2011 – Drinking Water System Components – Lead Content

.13 International Association of Plumbing and Mechanical Officials

.1 IAPMO PS 117-2016 – Press and Nail Connections

1.2 SHOP DRAWING AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 22 05 00 – Common Work Results for Plumbing.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 A product being named as “approved equal” does not relieve the manufacturer’s responsibility to ensure that his/her products are registered as per the requirements of CSA B51. Only products registered as a category H fitting under CSA B51 shall be allowed to be installed on hot water systems designed to be operated above 65°C.

2.2 PIPING

.1 Domestic hot, cold and recirculation systems, within building, including tempered and treated water unless noted otherwise, up to 100 mm diameter:

.1 Above-ground or buried plastic, up to 32 mm: PEX piping to CSA B137.5, ASTM F876 and ASTM F877, listed to NSF-61.

.2 Trap primer piping, from trap primer air gap to trap: As shown above or PEX to CSA B137.5.

2.3 FITTINGS

.1 All fittings used on potable water systems must be "Lead-Free" according to the requirements of NSF/ANSI 372.

.2 PEX Piping: Lead-free Brass mechanical joint.

2.4 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to ANSI/AWWA C111/A21.11.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Teflon tape: for threaded joints.

.4 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.5 SWING CHECK VALVES

.1 Dual-Check, lead free, 50 mm and under, screwed:

.1 Lead free bronze dual-check valve for backflow prevention on plumbing fixtures with mixing valves, replaceable check modules, to CSA B64.6, SS springs, Buna-N Seat Discs.

.2 Acceptable material: Apollo valve DuCLF4A, Watts LF7R, Zurn 700 XL, or approved equal.

2.6 BALL VALVES

.1 25mm and under, PEX mechanical connection:

.1 Lead-free copper alloy ball valve, to MSS SP-110, full port, PTFE seat, pressure rating 600 PSI CWP, chrome plated ball, lead-free to NSF/ANSI-372.

.2 Insulated pipes: Install with lever extension.

.3 Acceptable material: Nibco/NCI PX-CP400-LF, Red-White Valves 5010AB or approved equal.

Part 3 Execution

3.1 APPLICATION

.1 Comply with manufacturer's written recommendations including product technical bulleting, handling, storage and installation instructions and data sheets.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.

.4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.5 Install DCW piping below and away from DHW and all other hot piping so as to maintain temperature of cold water as low as possible.

.6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

.7 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 22 05 00 – Common Work Results for Plumbing.

.2 Test pressure: greater of maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 As per section 22 08 00 – Commissioning for Plumbing.

3.5 PRE-COMMISSIONING INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that systems can be completely drained.

3.6 COMMISSIONING

.1 To section 22 08 00 – Commissioning for Plumbing

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A126-04(2014), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-17, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA).

.1 AWWA C700-15, Cold Water Meters-Displacement Type, Bronze Main Case.

.2 AWWA C701-15, Cold Water Meters-Turbine Type for Customer Service.

.3 AWWA C702-15, Cold Water Meters-Compound Type.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64.10-17, Selection and installation of backflow preventers

.2 CSA-B64.10.1-17, Maintenance and field testing of backflow preventers

.3 CSA-B356-10(R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 CSA B51-14, Boiler, Pressure Vessel and Pressure Piping Code.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 Plumbing and Drainage Institute (PDI).

.1 PDI-WH201-2010, Water Hammer Arresters Standard.

.6 American National Standards Institute (ANSI)

.1 NSF/ANSI 372-2016, Drinking water system components – Lead content

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 22 05 00 – Common Work Results for Plumbing.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

.4 A product being named as "approved equal" does not relieve the manufacturer's responsibility to ensure that his/her products are registered as per the requirements of CSA B51. Only products registered as a category H fitting under CSA B51 shall be allowed to be installed on hot water systems designed to be operated above 65°C.

2.2 WATER HAMMER ARRESTORS

.1 Stainless Steel construction, bellows type, PDI-WH 201 certified.

.2 Acceptable material: Jay R. Smith 5000 series, Mifab WHB, Zurn Z1700, Watts WSS or approved equal.

2.3 BACK FLOW PREVENTERS

.1 To CAN/CSA-B64 Series.

.2 Basis of Design: Refer to Schedule on drawings

.3 Lead-Free Reduced pressure principle type:

.1 Sizes up to 50 mm: Threaded.

.1 Bronze construction, CSA approved, supplied with quarter turn ball valves and test cocks as per CSA-B64, lead-free to NSF/ANSI-372.

.2 Install with strainer on inlet side and air gap on relief.

.3 Acceptable material: Watts LF009QT, Wilkins 975XL2, Apollo 40LF-200-T2 or approved equal.

.4 Refer to schedules on drawing for sizes and accessories.

2.4 HOSE BIBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

.2 Basis of Design: Refer to Schedule on drawings

.1 Acceptable material: Nibco, Crane Valves, Dalh valves, Acorn, Zurn, or approved equal.

2.5 TRAP SEAL PRIMERS

.1 Electronic Trap seal primer

.1 Hard-wired electric solenoid valve complete with air-gap fitting and multi-seal distribution unit.

.2 Supply with control timer.

.3 Distribution unit and supply voltage as indicated by model number.

.4 Acceptable material: PPP Inc. MP-500, Zurn Z1020 or approved equal.

.2 Refer to schedule for model numbers and accessories.

.3 Install trap seal primers with air-gap fittings unless primer is installed on a dedicated non-potable water line.

2.6 STRAINERS

.1 Lead-free strainers:

.1 860 kPa, Y type with perforated stainless steel removable screen.

.2 50 mm and under, bronze body, screwed ends, with brass cap, 1.2 mm perforations, lead-free to NSF/ANSI-372.

.1 Acceptable material: Apollo 59LF, Wilkins YBXL, Watts LF777SI or approved equal.

2.7 PRESSURE RELIEF VALVE

.1 Bronze body, ASME rated, safety relief valve.

.2 Capacity as indicated.

.3 Acceptable material: Watts series 174A, Apollo Valves series 10-600, Zurn P3000BR or approved equal.

2.8 POTABLE WATER THERMAL EXPANSION TANK

.1 Fixed bladder or diaphragm type thermal expansion tank for potable water systems.

.2 Bladder or diaphragm: heavy-duty butyl rubber.

.3 Capacity: as indicated.

.4 Acceptable material: Watts PLT, Amtrol Ex.Trol or approved equal.

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 data sheet.

3.2 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 WALL HYDRANTS

.1 Install 600 mm above finished grade unless otherwise indicated.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

.2 If branch supply line to fixture group is longer than 6m, install two water hammer arrestors, one at end of line and one at mid-line, who combined will absorb the total amount of fixture units on the branch line.

.3 Water hammer sizes shall be as follows:

- .1 1-11 fixture units: Size A
- .2 12-32 fixture units: Size B
- .3 33-60 fixture units: Size C
- .4 61-113 fixture units: Size D
- .5 114-154 fixture units: Size E
- .6 155-330 fixture units: Size F
- .7 Size A through F to be as certified by PDI.
- .8 Fixture units shall be as described in the National Plumbing Code – 2015, table 2.6.3.1.

.4 Install B type water hammer arrestor at each flush valve water closet.

3.5 BACK FLOW PREVENTERS

.1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Install in an accessible location at a height of at least 750 mm and no more than 1500 mm.

.3 Bypass pipe discharge on RP backflow preventers to terminate over nearest funnel drain, open drain or service sink, or as indicated.

3.6 TRAP SEAL PRIMERS

.1 Install for all floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.

.3 Install soft copper tubing to floor drain.

3.7 STRAINERS

.1 Install with sufficient room to remove basket.

3.8 WATER METERS

.1 Install water meter provided by local water authority if applicable.

.2 Install water meter as indicated.

3.9 WATER MAKE-UP ASSEMBLY

.1 Pipe discharge from relief valve to nearest funnel floor drain.

3.10 COMMISSIONING

.1 To section 22 08 00 – Commissioning for Plumbing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International Inc.

.1 ASTM D2564-12, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA-Series B1800-15, Thermoplastic Non-pressure Pipe Compendium - B1800 Series.

.2 CAN/CSA-B125.3-12, Plumbing Fittings.

.3 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 PLASTIC PIPING AND FITTINGS

.1 Buried sanitary and vent: SCH 40 PVC pipe to CSA-B181.2.

.2 For above-ground sanitary and vent piping:

.1 PVC DWV Pipes to CSA B181.2

.3 For above-ground sanitary and vent piping in **plenum ventilation zones**:

.1 PVC DWV Pipes to CSA B181.2 and ULC S102.2

.2 Acceptable materials: Ipex system XFR 15-50 or approved equal.

.4 Joints.

.1 Solvent weld for PVC: to ASTM D2564.

Part 3 Execution

3.1 APPLICATION

.1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

.2 Install buried pipe on 150 mm bed of clean washed sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with 150 mm of clean washed sand.

.3 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.4 Install all sanitary drains water piping at a minimum downward slope of 1:50 unless stated otherwise.

3.3 TESTING

.1 Except in the case of an external leader, after a section of a drainage system or a venting system has been roughed in, and before any fixture is installed or piping is covered, a water pressure test or an air pressure test shall be conducted.

.2 A water pressure test shall consist in applying a water column of a t least 3m to all joints.

.1 In making a water pressure test:

.1 Every opening except the highest shall be tightly closed with a testing plug or a screw cap.

.2 The system or the section shall be kept filled with water for 15 min.

.3 Air pressure tests shall be conducted in accordance with the manufacturer's instruction for each piping material and as per the following:

.1 Air shall be forced into the system until a pressure of 35 kPa is created.

.2 This pressure shall be maintained for at least 15 min without a drop in pressure.

3.4 COMMISSIONING

.1 To section 22 08 00 – Commissioning for Plumbing

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA B79-08(R2013), Commercial and residential drains and cleanouts

.2 PDI-G101-2015, Testing and Rating Procedure for Grease Interceptors.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 22 05 00 – Common Work Results for Plumbing

Part 2 Products

2.1 Prior Approval of Products

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 FLOOR DRAINS

.1 Floor drains: to CSA-B79.

.2 FD-1: General Service Floor Drain.

.1 General service floor drain, to be used in bathrooms and other finished areas, with reversing flashing collar to permit adjustment of the strainer to meet finished floor level.

.2 Cast Iron construction with 150mmØ nickel bronze strainer head, no-hub outlet.

.3 Pipe size as indicated on drawing.

.4 Supply with sediment bucket, trap primer connection, vandal proof screws, p-trap.

.5 Acceptable Material:

.1 Basis of design: Refer to schedule on drawings:

.2 Other acceptable material: Jay R. Smith 2005Y-B-P050-U(A), Zurn ZN415B6-Y-P-VP, Watts FD-100-C-A6-1-5-6-7, or approved equal.

.3 FD-2: Mechanical Room Funnel Floor Drain

.1 General service floor drain complete with funnel for indirect waste lines, with reversing flashing collar to permit adjustment of the strainer to meet finished floor level.

.2 Cast Iron construction with 150mmØ nickel bronze strainer head and 160mm x 64mm x 25mm high oval funnel, no-hub outlet.

.3 Pipe size as indicated on drawing.

.4 Supply with sediment bucket, trap primer connection, vandal proof screws, p-trap.

.5 Acceptable material:

.1 Basis of design: Refer to schedule on drawings.

.2 Other acceptable material: Jay R. Smith 3510Y-B-P050-U(Fig. 3590), Zurn ZN415R-Y-P-VP c/w ZN329 Funnel, Watts model FD-100-C-FC7-1-5-6-7-G-1, or approved equal.

.4 FD-3: Garage Floor Drain

.1 Heavy-duty drains with offset outlet, hinged grate and free-standing sediment bucket, cast iron body, with flange, threaded outlet, vandal proof grate. Grate dimensions: 355mm x 405mm.

.2 Acceptable material:

.1 Basis of design: Refer to schedule on drawings.

.2 Other acceptable material: Jay R. Smith 2410C-U-G or approved equal.

2.3 CLEANOUTS

.1 Cleanouts to CSA B-79.

.2 CO-1, Floor Cleanouts:

.1 Finished Floors:

.1 Application: For use in floors with light finish (paint, vinyl sheeting, epoxy finish, carpeted floors, etc.).

.2 Cast Iron cleanout with round adjustable scoriated secured 145mm diameter nickel bronze vandal-proof top, taper thread bronze plug. Complete with speedi-set gasketed outlet.

.3 Acceptable material: Jay R. Smith 4033L-U, Zurn ZN1400-NL-BP-VP, Watts CO-200-R-1-P-6-34B, or approved equal.

.4 Use Flashing Flange and Flashing Clamp in floors with continuous waterproof membranes.

.5 Use carpet cleanout marker for carpeted floors.

.2 Tile Floors:

.1 Application: For use in floors and areas which are covered with a floor covering such as asphalt or vinyl tile, linoleum, etc.

.2 Cast Iron cleanout with round adjustable secured 145mm diameter nickel bronze vandal-proof top with 3mm tile recess, taper thread bronze plug. Complete with speedi-set gasketed outlet.

.3 Acceptable material: Jay R. Smith 4153L-U, Zurn ZN1400-NL-B-VP-X, Watts CO-200-RX-4-P-6-34B, or approved equal.

.4 Use Flashing Flange and Flashing Clamp in floors with continuous waterproof membranes.

.5 Coordinate finish with architectural contractors.

.3 Terrazzo/Ceramic Floors:

.1 Application: For use in floors and areas which are covered with a floor covering which requires a deep recess, such as Terrazzo floors and ceramic tiles.

.2 Cast Iron cleanout with round adjustable secured 145mm diameter nickel bronze vandal-proof top with 13mm Terrazzo recess, taper thread bronze plug. Complete with speedi-set gasketed outlet.

.3 Acceptable material: Jay R. Smith 4193L-U, Zurn ZN1400-NL-BP-Z-VP, or approved equal.

.4 Use Flashing Flange and Flashing Clamp in floors with continuous waterproof membranes.

.5 Coordinate finish with architectural contractors.

.4 Heavy-Duty:

.1 Application: For use in mechanical rooms, electrical rooms and/or unfinished floors.

.2 Cast Iron cleanouts with round adjustable scoritated secured 180mm diameter vandal-proof cast iron top, taper thread bronze plug, built for heavy-duty applications. Complete with speedi-set gasketed outlet.

.3 Acceptable material: Jay R. Smith 4233L-U, Zurn Z1400-NL-BP-VP, or approved equal.

.4 Use Flashing Flange and Flashing Clamp in floors with continuous waterproof membranes.

.3 CO-2, stack cleanout:

.1 Exposed – Unfinished areas:

.1 Application: On drainage side of grease interceptor.

.2 Cleanout tee and countersunk taper thread plug

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum 100 mm Ø.

3.3 COMMISSIONING

.1 To section 22 08 00 – Commissioning for Plumbing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 .

.2 Canadian Standards Association (CSA International)

.1 CSA B51-14, Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CAN/CSA C22.2 No.110-94(R2014), Construction and Test of Electric Storage Tank Water Heaters.

.3 CAN/CSA-C191-13, Performance of Electric Storage Tank Water Heaters for Household Service.

.4 CAN/CSA-C309-M90(R2014), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 22 05 00 – Common Work Results for Plumbing.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 ELECTRIC WATER HEATER

.1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with immersion type elements, and surface mounted or immersion type adjustable thermostats.

.2 Basis of Design: Refer to Plumbing Schedule on Drawings.

.3 Tank: glass lined steel, 50 mm insulation, enamelled steel jacket, 3 year warranty certificate.

.4 Dimensions and water volume: as indicated on drawings.

.5 Electrical data: as indicated on drawings.

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 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for horizontal mounted tanks and for instantaneous heaters.

.3 Provide insulation between tank and supports.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 COMMISSIONING

.1 Refer to section 22 08 00 – Commissioning for Plumbing.

END OF SECTION

Part 1 General

1.1 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.

.2 Equipment installed by others.

.1 Connect with unions.

.3 Equipment not installed.

.1 Capped for future connection by others.

1.2 REFERENCES

.1 American National Standards Institute

.1 ANSI/ARI 1010-02, Drinking Fountains and Self-Contained, Mechanically Refrigerated Drinking Water Coolers.

.2 CSA Group

.1 CAN/CSA-B45 Series-02(R2013), CSA Standards on Plumbing Fixtures.

.2 CAN/CSA-B125.3-12, Plumbing Fittings.

.3 CAN/CSA-B651-12(R2017), Accessible Design for the Built Environment.

.3 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1168-A2011, Adhesive and Sealant Applications.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 22 05 00 – Common Work Results for Plumbing.

.2 Indicate, for all fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

.2 Factory-set water consumption per flush at recommended pressure.

.3 (For water closets, urinals): minimum pressure required for flushing.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not

found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: Architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

.7 Water closets: As per schedule on drawings.

.8 Fixture piping.

.1 Hot and cold water supplies to each fixture:

.1 Exposed:

.1 Heavy pattern, chrome plated finish, angle supplies, lockshield, screwdriver slot, stuffing box cartridge, 3/8 IPS brass inlet supply nipple, 9.5mm OD x 305mm long flexible riser tube, stainless steel wall flange.

.2 Hidden and/or within cabinets:

.1 Heavy pattern, chrome plated finish, angle supplies, lockshield, screwdriver slot, stuffing box cartridge, 3/8 IPS brass inlet supply nipple, 9.5mm OD x 305mm long flexible braided stainless steel riser, stainless steel wall flange.

.2 Waste:

.1 Brass P trap with cleanout on each fixture not having integral trap.

.2 Chrome plated in all exposed places (including within cabinets).

.3 Grid strainer, basket strainer or plugs: as indicated on drawings.

2.3 APPLICATION

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

2.4 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Standard fixtures: as indicated, measured from finished floor:

.1 Lavatory: top of bowl @ 787mm AFF.

.2 Handwash sinks: top of bowl @ 865mm AFF.

.3 Kitchen sinks: top of bowl @ 914mm AFF.

.3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

.1 Wall-mounted Lavatory: top of bowl @ 838mm AFF.

.2 Wall-mounted Drinking Fountain: spout opening @ 889mm AFF.

.4 In an event where the mounting heights shown on Architectural drawings differ from those mentioned herein, the Architectural drawings shall govern.

2.5 COMMISSIONING

.1 To section 22 08 00 – Commissioning for Plumbing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Research Council of Canada

.1 National Building Code of Canada (2015)

.2 Canadian Standard Association

.1 CAN/CSA B52-13: Mechanical Refrigeration Code

.2 CAN/CSA B149.1-15: Natural Gas and Propane Installation Code

.3 National Fire Protection Association

.1 NFPA 96-17: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations,

1.2 SCOPE OF WORK

.1 The HVAC contractors shall furnish all labour, materials, tools, appliances and equipment to entirely complete and provide for the operation of the heating, ventilation, and air conditioning systems, as indicated in these specifications, and as shown on drawings.

1.3 WORK INCLUDED IN DIV. 23

.1 The overall intention is to provide finished systems complete in all aspects, including all items reasonably inferable as called for by the plans and specifications and by normally accepted good practices, notwithstanding that every item required may not be specifically mentioned. The work includes, but is not limited to the following:

.1 Ventilation (included in Ventilation contract):

.1 Supply and install any and all fans, equipment, ductwork, terminal units, grilles, diffusers, coils, dampers, louvers, filters, hangers, supports and accessories for all new HVAC ventilation systems according to these specifications and the National Building Code, including but not limited to:

.1 HRV-1

.2 Include all testing, adjusting and balancing of ventilation equipment and ductwork as required by these specifications.

.2 Supply and install any and all fans, hoods, equipment, ductwork, dampers, louvers, filters, coils, hangers, supports and accessories for all new kitchen exhaust and make-up systems according to these specifications, NFPA-96 and the National Building Code, including but not limited to:

.1 MUA-1

.2 EF-1

.3 KH-1

.4 Include all testing, adjusting and balancing of ventilation equipment and ductwork as required by these specifications and NFPA-96.

.3 Provide duct cleaning when required. Refer to Section 23 31 13 – Metal Ducts for conditions of requirement.

.4 Provide any and all documents and submissions as mentioned in Section 23 05 00 – Common Work Results for HVAC and any other relevant section.

.5 All insulation and identification of ductwork and equipment which are the responsibility of this contractor shall also be the responsibility of this contractor.

.6 All vibration isolation equipment required for ducts and equipment under the responsibility of this contractor shall also be the responsibility of this contractor.

.7 Commission ventilation equipment and system according to section 23 08 00 – Commissioning for HVAC.

.2 Heat-pump:

.1 Supply and install any and all heat-pumps, equipment, piping, hangers, supports and accessories for new heat-pump Systems according to these specifications and CSA B52, including but not limited to:

.1 OU-1, IU-1 and IU-2

.2 Include all filling, testing, adjusting and balancing of refrigerant piping and equipment as required by these specifications.

.3 Provide any and all documents and submissions as mentioned in Section 23 05 00 – Common Work Results for HVAC and any other relevant section.

.4 All insulation and identification of refrigerant piping and heating equipment installed under Div. 23 shall be the responsibility of this contractor.

.5 All vibration isolation equipment required for piping and equipment under the responsibility of this contractor shall also be the responsibility of this contractor.

.6 Commission refrigerant system according to Section 23 08 00 – Commissioning for HVAC.

.3 Propane:

.1 Supply and install any and all tanks, equipment, piping, valves, hangers, supports and accessories for new Propane Systems according to these specifications and the CSA B149.1 standard, including but not limited to:

.1 Kitchen equipment (supplied by others, installed by this contractor)

.2 MUA-1

.2 Include all filling, testing, adjusting and balancing of piping and equipment as required by these specifications.

.3 Include all connections to make-up air units and other equipment supplied and installed by Ventilation contractor.

.4 Provide any and all documents and submissions as mentioned in Section 23 05 00 – Common Work Results for HVAC and any other relevant section.

.5 All identification of gas piping and heating equipment installed under the responsibility of this contractor shall also be the responsibility of this contractor.

.6 All vibration isolation equipment required for piping and equipment under the responsibility of this contractor shall also be the responsibility of this contractor.

.7 Commission gas systems and equipment according to Section 23 08 00 – Commissioning for HVAC.

1.4 WORK NOT INCLUDED IN DIV. 23

.1 Excavation and backfill work shall be the responsibly of the General Contractor.

.2 Any and all electrical wiring above 50V shall be the responsibility of Div. 26.

.3 All architectural finishes (including painting), core drilling, cutting, and patching shall be the responsibility of the general contractor, in accordance with section 23 05 00 – Common Work Results for HVAC.

.4 Any required trenching of floors, or removal of existing T-bar ceilings for the running of piping or ductwork shall be the responsibility of the General Contractor.

.5 Firestoping of penetrations through walls and floors shall be the responsibility of the general contractor, with the exception of mechanical firestoping mentioned elsewhere in these specifications and in accordance with section 23 05 00 – Common Work Results for HVAC.

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 GENERAL PROVISION

.1 This section covers items common to all sections of Division 23 and is intended only to supplement the requirements of Division 01.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-16, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

1.3 DESCRIPTION OF WORK

.1 Work under this division covers all labour, materials and equipment required for installing and placing in operation the mechanical systems as specified herein and as shown on the drawings.

1.4 RESPONSIBILITY FOR TRIAL USAGE

.1 Obtain written permission from Consultant to start and test permanent equipment and equipment and systems prior to acceptance by Owner.

.2 Comply with the requirements of Architect/ Consultant in connection with the use of these systems and equipment.

.3 Such use of permanent equipment and systems shall in no way prejudice the period of guarantee of all equipment and systems which shall commence upon the acceptance of the building by the Owner as substantially complete.

.4 Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, materials and instruments required for testing.

.5 Such tests shall not be construed as evidence of acceptance of any part of the contract and it is agreed and understood that no claim for damage will be made for any injury or breakage to any part or parts of the tested equipment due to the aforementioned tests.

1.5 EXAMINATION OF SITE AND DRAWINGS

.1 Examine the site and local conditions affecting the work of this contract prior to submitting tender.

.2 Before commencing any work, examine the work of other trades including electrical and report at once any defects or interference affecting the work of this division.

.3 Notes on the drawings are intended to form a part of this specification.

.4 The mechanical drawings do not show all structural details of the building. Any information involving accurate dimensions of the building shall be taken from the figured dimensions on the architectural drawings or by measurements taken on site.

.5 The contractor shall make, without additional charge, any necessary changes to accommodate structural conditions as built or existing.

.6 As work progresses and before installing fixtures, fittings, or equipment which may interfere with the interior treatment or use of the building, consult with the Architect/ Consultant on the exact location of such equipment.

.7 The drawings indicate the general location and route of pipes, ducts, etc. Where required piping, etc., are not shown, or shown diagrammatically, they shall be installed to conserve head room and space.

.8 The plans do not necessarily show all valves, unions, etc. The Contractor shall not avail himself to these obvious omissions but shall install the work complete in essential details that it will function properly and so that repairs or removal of equipment can easily be accomplished.

.9 The drawings are intended to serve as a guide to the Contractor. It is the contractor's responsibility to coordinate work on-site to ensure that all trades can be installed while following these specifications and maintaining the general intent of the drawings.

.10 Bidders finding discrepancies in, or omissions from the drawings, specifications, or other documents, or having any doubts as to the intent or meaning of any part thereof, shall immediately notify the Architect/ Consultant who will send written instructions or explanations to all bidders. Neither the Architect/Consultant, or the Owner will be responsible for oral instructions.

1.6 SITE COORDINATION

.1 Coordinate the HVAC work with the work of other trades to facilitate the progress of the work as a whole.

.2 Consultant has provided coordinated drawings as proof of concept, however this does not alleviate the contractor's responsibility to coordinate work on-site to ensure that all trades will be able to be installed in space available.

.3 Any change in the work or schedule caused by failure to coordinate trades shall not be considered as a claim for extra compensation.

1.7 CHANGES AND EXTRAS

.1 No change to the drawings and specifications will be accepted, if not authorized in writing by the Architect/Consultant.

.2 All work carried out which does not conform to the plans and specifications shall be corrected at the Contractor's expense.

.3 The Owner reserves the right to change quantity, quality, or any kind of work or equipment described on the drawings or in the specifications without affecting the validity of the contract.

.4 Monetary adjustments required by such changes shall be accepted in writing by the Architect/Consultant before alterations are proceeded with by the Contractor.

1.8 LAWS AND ORDINANCES

.1 All work performed under this division shall comply with the requirements of the authorities having jurisdiction, including, but not limited to, the following: Provincial Department of Labour, Provincial Department of Environment, Provincial Fire Marshall, Provincial Board of Insurance Underwriters, Provincial Department of Health, Plumbing Inspector, Building Inspector, National Building Code of Canada, Local and Municipal By-Laws and Canadian Standards Association.

1.9 INSPECTIONS

.1 Consultant reserves the right to require an inspection of work prior to any part of the work which may conceal work being done. This includes but is not limited to underground inspections, open wall inspections and open ceiling inspections.

.2 Contractor shall be responsible to schedule work in a manner which shall limit the number of inspections required to one per area per phase of work (underground, open wall, open ceiling, etc.).

.3 Advise Consultant minimum 72 hours in advance for all inspections required. Provide for a minimum of 48h window where Consultant may choose to perform his inspection. This includes, but is not limited to, open ceiling, open wall, substantial, final and additional inspections as requested in following technical sections.

1.10 GUARANTEE

.1 All mechanical work and equipment shall be guaranteed to work satisfactorily for a period of one year from the date of acceptance of substantial completion of the contract, provided any failure is not due to neglect or improper use by the Owner.

.2 Any certificate given, payment made, partial or entire use of the equipment by the Owner, shall not be construed as acceptance of defective work or improper materials.

.3 This general guarantee shall not act as a waiver of any specified guarantee for any greater length of time.

1.11 SUBMITTALS

.1 Submittals: in accordance with Section 01 11 00 – General Requirements.

.2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.

.3 Shop drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.6 Equipment control schematics and available control points, where applicable.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 11 00 – General Requirements.

.2 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports.

.6 Approvals:

.1 Submit 3 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.

.2 Make changes as required and re-submit as directed by Consultant.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for plumbing, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Consultant for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for plumbing using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.12 PERMITS AND TAXES

.1 This Contractor shall apply for and pay all necessary municipal permits. All Provincial and Municipal taxes shall be included in the tendered amount.

.2 Contractor shall arrange for all inspections of work by these authorities.

.3 All materials and labour required to conform to any or all of the regulations imposed by the authorities having jurisdiction over the contract shall be included by the Contractor in his tender. There shall be no additional charges to the Owner.

1.13 STAGING

.1 This contractor shall supply all staging and equipment necessary for the installation of his work.

1.14 LABOUR AND WORKMANSHIP

.1 All tradesmen employed by this Contractor for this work shall be properly licensed journeymen and apprentices qualified to do work in each particular trade. The Architect/Consultant shall have the right to examine each man's credentials and order any unqualified personnel away from the project.

.2 This Contractor shall be completely responsible for the proper execution of the work as outlined in the plans and specifications. This Contractor shall assume responsibility for workmanship and material defects whether or not they are discovered by the Architect/Consultant.

1.15 DEFICIENCY LISTS

.1 The Architect/Consultant will notify this Contractor at various intervals of defective workmanship or installation deficiencies, etc. This Contractor shall not request revised or updated lists without first submitting a current detailed, item by item report on the status of all deficiencies as reported to the Contractor on a previous listing.

.2 When the Contractor notifies the Architect/ Consultant that the contract is ready for final inspection, a comprehensive deficiency listing will be prepared. If such list exceeds twenty (20) items, the contract shall not be considered ready for final inspection and the Architect/ Consultant need to furnish the Contractor with such listing.

1.16 METRIC DESIGNATION OF NOMINAL PIPE SIZES

.1 For the purposes of this contract only, pipes and tubes shown in this specification and on accompanying drawing(s) have been given metric nominal sizes in accordance with the following table:

In.	mm	Ins.	mm	Ins.	mm	Ins.	mm
1/4	6	2 1/2	65	15	375	36	900
5/16	8	3	75	16	400	39	975
3/8	10	3 1/2	90	18	450	40	1000
1/2	12	4	100	20	500	44	1100
5/8	16	5	125	21	525	48	1200
3/4	20	6	150	22	550	52	1300
7/8	22	7	175	pl.	560	56	1400
1	25	8	200	24	600	60	1500
1 1/8	28	9	225	pl.	630	64	1600
1 1/4	32	10	250	26	650	72	1800
1 3/8	35	11	275	27	675	Then by multiples of 200 mm to 4000 mm	
1 1/2	40	pl.	280	28	700		
1 5/8	41	12	300	pl.	710		
1 3/4	44	pl.	315	30	750		
1 7/8	47	14	350	32	800		
2	50	pl.	355	33	825		

Notes:
pl. – listed in CGSB.41 – Plastic Series.

.2 It should be understood by all concerned that there is no intended physical change in the sizes of pipes, tubes, fittings, valves and screw threads. They are simply given a metric nominal designation.

1.17 METRIC SYMBOLS

.1 All metric symbols used in this specification and on the accompanying drawings are those used in National Standard of Canada, CAN3-Z234.1, Canadian Metric Practice Guide.

1.18 METRIC DESIGNATION OF SHEET METAL GAUGES

.1 For the purpose of this contract only, sheet metal gauges shown on this specification and on the accompanying drawing(s) are given in millimeter thicknesses in accordance with the following table of gauge equivalents:

Nominal Thickness in mm	Hot or Cold Rolled Steel	Stainless Steel	Galvanized Steel	Aluminium
0.4	28	28	30	26
0.5	26	26	28	24
0.6	24	24	26	22
0.8	22	22	22 to 24	20
1	20	20	20	18
1.2	18	18	18	16
1.5	16	16	16	14
2	14	14	14	12
2.5	12	N/A	N/A	10
3	N/A	12	12	N/A
3.5	10	10	N/A	8
4	8	N/A	N/A	6
4.5	N/A	8	N/A	N/A

1.19 QUALITY ASSURANCE

.1 Quality assurance in accordance with Section 01 45 00 – Quality Controls.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.20 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 – Cleaning.

1.21 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 11 00 – General Requirements as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.6 Two spare cylinders for each humidifier

.7 One set of belts for each belt drives.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 11 00 – General Requirements.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 MATERIALS

.1 All materials used in this project must be purchased directly through jobbers, manufacturers' agent, wholesalers and suppliers havingn an established office in the Maritime provinces and purchased through Maritime representatives. By submitting a tender, this contractor acknowledges his responsibility.

2.2 STANDARD OF ACCEPTANCE

.1 Means that item named and specified by catalogue number forms part of specification regarding performance, quality of materials and workmanship.

.2 Tender price shall be based upon materials as specified. Manufacturer's products that are not named in the specifications must receive approval from the Architect/Consultant prior to the tender closing date. See section 00 21 00 – Notice of Tender.

.3 All designs are based on units numbered in schedules on drawings or stated as being "basis of design" in the spec. If approved equal is chosen, contractor shall be responsible for any and all modifications required to make unit fit, including but not limited to mechanical, electrical, architectural and structural modifications.

2.3 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 General:

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

.3 Motors:

.1 Motors under 1/2 HP: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.2 Motors 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, voltage and number of phases as indicated elsewhere.

.4 Motors 2 HP and larger for Variable Frequency Drive application:

.1 Inverter duty, with internal or external maintenance-free Shaft Grounding Bearing Protection Ring.

.5 Temporary Motors:

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Consultant for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame.
.2 Minimum 1.2 mm thick sheet metal tops and bottoms.
.3 38 mm dia holes on both shaft centres for insertion of tachometer.
.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
.2 Securely fasten in place.
.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

2.6 EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 23.

.2 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm high and 50 mm larger than equipment dimensions all around.

.3 Supply anchor bolts and templates for installation by other division.

2.7 FIRESTOPPING

.1 All penetrations through all fire separations (Wall and floor penetrations) are to be fire stopped.

.2 All firestopping by general contractor with the exception of mechanical firestopping as specified elsewhere in Division 23. Refer to Section 07 84 00 – Firestopping.

.3 Mechanical contractors to coordinate number, size and locations of openings with general contractor.

2.8 SPECIAL TOOLS AND SPARE PARTS

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

.2 Identify spare parts containers as to contents and replacement parts number.

2.9 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: use prime coated steel.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

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 piping, ducting and equipment installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

3.2 INSTALLATION

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

.3 Equipment drains: pipe to floor drains.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

.5 Provide accessible means for lubricating equipment including permanent lubricated bearings.

.6 A minimum clearance of 2.2 m shall be maintained unless otherwise stated or impossible to achieve. Where headroom will be less than 2.0 m from the finished floor, pipe or duct runs shall be approved by the Architect/Consultant.

3.3 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

.2 protect all equipment, piping, fixtures, ductwork, etc. throughout the construction period and assume responsibility for the same.

3.4 CUTTING AND PATCHING

.1 Cutting and patching shall be the responsibility of the general contractor. Mechanical contractor to coordinate location of openings for mechanical equipment with general contractor.

.2 Core drilling for mechanical equipment and piping shall be by general contractor. Refer to section 03 82 13 – Concrete Core Drilling and Sawing. Mechanical contractor to coordinate location of openings for mechanical equipment and piping with general contractor.

.3 In new installations, painting of patches shall be by general contractor.

.4 If, however, cutting and patching is required to fix a defect and/or omission which is the responsibility of the Mechanical contractor, of if mechanical contractor chooses alternate routings which would increase the amount of cutting and patching, all cutting and patching costs required to cover this defect and/or omission and/or alternate routing shall be carried by the Mechanical contractor.

3.5 CONCEALMENT

.1 Unless otherwise shown or specified, all ducts and piping shall be run concealed in ceilings, walls, partitions, etc. Heating risers and water piping shall not be concealed in exterior walls without adequate thermal protection.

3.6 ELECTRICAL

.1 Electrical work to conform to Division 26 including the following:

.1 Supplier and installer responsibility is indicated on electrical drawings and related mechanical responsibility is indicated on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25. Refer to Division 26 for quality of materials and workmanship.

3.7 PREPARATION FOR FIRESTOPPING

.1 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe to move without damaging firestopping material.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

3.8 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

3.9 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units as per section 23 05 65 – Duct Cleaning.

.2 Clean piping in accordance with section 23 08 00 – Commissioning for HVAC.

.3 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

3.10 COMMISSIONING

.1 Refer to section 23 08 00 – Commissioning for HVAC.

.2 All contractors shall be available for commissioning process described in section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

.1 All bugs relating to mechanical equipment shall be fixed during commissioning process so that commissioning can be completed in a timely fashion. All deficiencies shall be fixed at no extra cost.

.2 Contractor shall perform any and all test on their own equipment as required by manufacturer and as described in equipment's relevant section in order to ensure that their equipment is functioning properly prior to EMCS commissioning.

3.11 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as required as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Consultant will record these demonstrations on video tape as required for future reference.

.6 Where specified elsewhere in Division 23, manufacturers to provide demonstrations and instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 Canadian Standards Association (CSA International)

.1 CSA B139-15, Installation Code for Oil Burning Equipment.

.2 CAN/CSA B214-16, Installation Code for Hydronic Heating Systems

.3 National Fire Code of Canada (NFCC 2015)

.4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2007, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 MATERIAL

.1 Paint: zinc-rich to CAN/CGSB-1.181.

.1 Primers, Paints and Coating: in accordance with manufacturer's recommendations for surface conditions.

.2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.3 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

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 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA B139 and National Fire Code of Canada.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as per CSA B139 without interrupting operation of other system, equipment and components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.1 Discharge to be visible.

.4 Drain valves: as specified elsewhere.

3.5 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 50 mm and under: isolating unions or bronze valves.

.4 Over 50 mm: isolating flanges.

3.6 PIPEWORK INSTALLATION

.1 Install pipework to CSA B139 and CSA B214 unless noted otherwise.

.2 Screwed fittings jointed with Teflon tape.

.3 Protect openings against entry of foreign material.

.4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.10 Install, except where indicated, to permit separate thermal insulation of each pipe.

.11 Group piping wherever possible and as indicated.

.12 Ream pipes, remove scale and other foreign material before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Provide for thermal expansion as indicated.

.15 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball or butterfly valves at branch take-offs for isolating purposes except where specified.

.7 Install butterfly valves between weld neck flanges to ensure full compression of liner.

.8 Use chain operators on valves 65 mm and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.16 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.

.2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.7 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.1 If hole is drilled in existing slab, sleeve shall not be required as long as hole is smooth and free of any jagged edges.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:

.1 Foundation walls, exterior walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere:

.1 Provide space for firestopping.

.2 Maintain fire rating integrity.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

.5 Where sleeves go through exterior walls, pipes shall be further sealed with “Fernco” type reducer flexible coupling to be mechanically sealed around both sleeve and pipe. Sleeve to be elongated on the exterior side accordingly.

3.8 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one piece type with set screws.

.1 Chrome or nickel plated brass or type 302 stainless steel..

.3 Sizes: outside diameter to cover opening or sleeve.

.1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRE STOPPING

.1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 Flush system in accordance with Section 23 08 00 – Commissioning for HVAC.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Give Consultant 48 h written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Consultant.

.3 Conduct tests in presence of Consultant.

.4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

.5 Hydronic Piping:

.1 Test according to CSA B214 – Installation code for hydronic heating systems.
.2 Maintain test pressure without loss for 1 h unless otherwise specified.
.3 Isolate heat source from system.
.4 Hydraulically test hydronic piping systems at 1½ times system operating pressure or minimum 420 kPa, whichever is greater.
.5 When an air pressure test is not recommended by a plastic piping manufacturer, a hydrostatic pressure test shall be performed.

.6 Other Piping:

.1 Maintain test pressure without loss for 4 h unless otherwise specified.
.2 Hydraulically test steam and other piping systems at 1½ times system operating pressure or minimum 860 kPa, whichever is greater.

.7 Equipment: test as specified in relevant sections.

.8 Bear costs including retesting and making good.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-16, Power Piping.

.2 ASTM International

.1 ASTM A125-1996(2013), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation.

.5 Underwriter's Laboratories of Canada (ULC)

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common work Results for HVAC.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.3 OPERATIONS AND MAINTENANCE DATA

.1 Provide operations and maintenance data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 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 B31.1 or MSS SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 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.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.3 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.4 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized or painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachments to wooded ceiling:

.1 Malleable iron ceiling flange, threaded rod.

.1 Acceptable material: Anvil fig. 128R or approved equal.

.3 Upper attachments to side wooded beam:

.1 Malleable iron, L shaped bracket. To MSS-SP-69, type 34, ULC listed.

.1 Acceptable material: Anvil fig. 202 or approved equal.

.4 Upper attachments to bottom of wooded beam:

.1 Screwed-in rod support, UL/FM and NFPA approved, 1760# pullout (Fir).

.1 Acceptable material: Sammy model GST-20 or approved equal.

.5 Rooftop support:

.1 Acceptable material: Eaton Dura-blok c/w B2000 and B2400 series supports.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.4 Cut excess rods at nut.

.5 Acceptable Material: Anvil fig. 146 or approved equal.

.7 Pipe attachments:

.1 Cold copper piping; hot copper piping with less than 25 mm horizontal movement; hot copper piping with more than 300 mm middle attachment (rod) length: adjustable clevis to MSS-SP-58, type 1, copper plated.

.1 Acceptable material: Anvil fig. CT-65 or approved equal.

.2 Suspended hot piping, copper, with horizontal movement in excess of 25 mm; hot steel piping with middle attachment (rod) 300 mm or less; pipe roller to MSS-SP-58, type 43.

.1 Acceptable material: Anvil fig. 171 or approved equal.

.3 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.

.1 Acceptable material: Anvil fig. 271 or approved equal.

2.5 RISER CLAMPS

.1 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.

.1 Acceptable material: Anvil fig. CT-121 or approved equal.

.2 Bolts: to ASTM A307.

.3 Nuts: to ASTM A563.

2.6 INSULATION PROTECTION SHIELDS

.1 Contractors shall have the option of installing pre-fabricated plastic insulation shields or metal insulation shields.

.1 Pre-fabricated plastic insulation shield:

.1 Insulated hot and cold piping:

.1 Pre-fabricated plastic insulation shield build from polypropylene copolymer, UV resistant, for operating temperatures of -40°C to 81°C, paintable, with non-adhesive surface for linear expansion of thermal insulation, ULC listed.

.2 Fire and smoke ratings in accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

.3 Shield shall be pre-fabricated with attachment system for connection to support.

.4 Acceptable material: Insuguard or approved equal.

.2 Metal insulation shields:

.1 Insulated cold piping:

.1 64 kg/m3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span. Ribbed to hold in pace on saddle.

.2 Acceptable material: Anvil fig. 168 or approved equal.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes 300mm and over, carbon steel to comply with MSS SP69.

.2 Acceptable material: Anvil fig. 160 to 166 or approved equal.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.8 OTHER EQUIPMENT SUPPORTS

.1 Submit structural calculations with shop drawings.

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 Provide supplementary structural steelwork where structural bearings to not exist or where concrete inserts are not in correct locations.

.2 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm or more,

.2 transfer of load to adjacent hangers or connected equipment is not permitted.

.3 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.

.2 variation in supporting effect does not exceed 25% of total load.

3.3 HANGER SPACING

.1 Gas piping: up to 12mm: every 1.8 m.

.2 Copper piping: up to 12mm: every 1.5 m.

.3 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.4 Within 300 mm of each elbow.

.5 Steel and copper piping greater than 12 mm:

Maximum Pipe Size:	Maximum Spacing Steel	Maximum Spacing Copper
up to 32 mm	2.4 m	1.8 m
40 nmm	3.0 m	2.4 m
50 mm	3.0 m	2.4 m
65 mm	3.7 m	3.0 m
75 mm	3.7 m	3.0 m
90 mm	3.7 m	3.3 m
100 mm	3.7 m	3.6 m
125 mm	4.3 m	
150 mm	4.3 m	
200 mm	4.3 m	
250 mm	4.9 m	
300 mm	4.9 m	

.6 Pipework greater than 300 mm: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Cut off excess rods at jam nut.

.4 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1-15, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Product data to include paint colour chips, other products specified in this section.

.3 Samples:

.1 Submit samples in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufactures products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.3 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20
10	50 x250	1	25

.2 Use maximum of 25 letters/numbers per line.

.1 Locations:

.1 Built-Up MUA and ERVs: use size #10

.2 Other Equipment in Mechanical Rooms: use size # 9.

.2 Content:

.1 HRV, MUA:

.1 1st line: "**AHU-???**" AHU's tag, as shown on drawings or as approved by Building Operator.

.2 Pumps, Fans, etc.:

.1 1st line: "**X-???"** Equipment's tag, as shown on drawings or as approved by Building Operator.

.3 All nameplate content to be approved by building operator prior to manufacturing.

2.4 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Consultant.

2.5 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Propane gas: to CSA/CGA B149.1.

2.6 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.7 Colours and Legends:

.1 All pipes on project are to be identified. Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: to following table:

Background colour:	**Legend, arrows:**
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Heat Pump Loop Supply	Yellow	HPS
Heat Pump Loop Return	Yellow	HPR
Propane	To CSA B149.1	
Regulator Vent	To CSA B149.1	
Notes: * Brackets are to be replaced by nominal design pressure in piping. Refer to drawings. ** Brackets are to be replaced by type of oil in piping. Refer to relevant spec section.		

2.7 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.8 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.9 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.10 LANGUAGE

.1 Identification to be in **English.**

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 TIMING

.1 Provide identification only after painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 7 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 American Society for Testing and Materials (ASTM).

.1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C335-10e1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547-15, Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.4 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-2016.

.5 Manufacturer's Trade Associations.

.1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common work Results for HVAC.

1.3 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.5 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CER: Rigid Insulation External Application

.2 CEF: Flexible Insulation External Application

.3 CUI: Buried Underground Application

.4 CRD: Round Ductwork Finish,

.5 CRF: Rectangular Finish.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

2.4 JACKETS

.1 Canvas:

.1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

2.5 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m2 cotton, plain weave.

.5 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.

.6 Tape: self-adhesive, aluminium, reinforced, 50 mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Canvas adhesive: washable.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.12 Fasteners: 4 mm diameter pins with 35 mm diameter square clips, length to suit thickness of insulation.

.13 Firestop insulation:

.1 Unfaced duct insulation or ULC labelled mineral wool insulation with minimum 64 kg/m^3 density compressed 50% minimum.

.14 Firestop Sealant:

.1 Sealant to be one-component, ready-to-use, silicone elastomer.

.2 Sealant shall be listed by independent test agencies such as UL and be tested to, and passed the criteria of, ASTM E 814, E 119, UL 2019 Fire Test, tested under positive pressure.

.3 The sealant must meet joint movement performance ratings of ASTM Specifications 920, Type 5, Grade NS, Class 25, Use NT, G and A.

.4 Acceptable material: 3M Fire Barrier 2000+ or approved equal.

2.6 FIRE-RATED DUCT-WRAP SYSTEM

.1 Duct-wrap insulation:

.1 Foil-encapsulated, non-combustible, inorganic, flexible fireproofing wrap, to conform to ULC/FRD-3 (for pressurised systems) or ULC/FRD-4 (for kitchen exhaust systems) fire-rated duct system.

.2 Needled alumina-silica fibre blanket encapsulated in an aluminum foil scrim, providing a non-combustible flexible wrap encased in foil to provide protection against grease absorption, water absorption and minimize dusting.

.3 Acceptable material: 3M FireMaster or approved equal.

.4 Minimum fire rating and thickness:

.1 2 layers of 38mm each for 2h rating.

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 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC Mechanical Insulation Best Practice Guide.

.1 Rigid Insulation, External Application:

.1 TIAC code **CER/1,** Hot ducts and plenums, 20 °C to 65 °C:

.1 Preparation: Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm centers, each direction.

.2 Application: Cut insulation without integral vapour retarder to required size and apply to exterior of duct and/or plenum, with horizontal surfaces overlapping vertical surfaces and edges tightly butted together. Secure insulation by impaling on mechanical fasteners.

.2 TIAC code **CER/2,** Cold or Dual-temperature Ducts and Plenums:

.1 Preparation: Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm on centers, each direction.

.2 Application: Cut insulation with integral vapour retarder to required size and apply to exterior of duct and/or plenum with vapour retarder to the warm side with horizontal surfaces overlapping vertical surfaces. Butt edges together tightly. Secure insulation by impaling on mechanical fasteners. Where mechanical fasteners penetrate vapour retarder, and at all corners and joints, apply self adhesive vapour retarder tape or vapour retarder strips adhered with vapour retarder adhesive. Where raised seams are encountered, add a strip of insulation above seam termination on each side of the seam, secure to the seams an overlapping strip of insulating material of equal thickness to the one required with integral vapour retarder to provide a continuous vapour retarder and seal all joints and edges with self adhesive vapour retarder tape.

.3 TIAC code **CER/3**, Outside Air Ducts and Plenums:

.1 As CER/2 above but firstly apply a layer of rigid insulation without vapour retarder before applying layer of rigid insulation with vapour retarder. All joints shall be staggered.

.4 For external applications of rigid insulation (CER/1 and CER/2) where the use of mechanical fasteners is unsuitable due to space limitations, wire fastenings, insulation adhesive or other suitable method of attachment may be substituted.

.5 TIAC code **CEF/2**, Cold or Dual-temperature Ducts and Plenums:

.1 Preparation: On rectangular ducts 750 mm or more in width, apply to bottom surface, either mechanical fasteners at approximately 300 mm centers or insulation adhesive in strips 100 mm wide on approximately 300 mm centers.

.2 Application: Cut insulation with integral vapour retarder to required size and apply to exterior or duct with vapour retarder to the outside. Where mechanical fasteners or staples penetrate the vapour retarder and at all joints apply vapour retarder tape or vapour retarder strips adhered with vapour retarder adhesive. All joints shall be overlapped a minimum of 50 mm and stapled on

approximately 100 mm centers. Secure insulation with wire fastening on approximately 300 mm centers.

.2 Other insulation types:

.1 TIAC code **CUI/1**, Buried Underground Insulation:

.1 Patented encasement type based on the particular characteristics of the insulation materials shall be used.

.2 Install the underground insulation in accordance with the manufacturer's recommendations and specifications.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: At 300 mm oc. in horizontal and vertical directions, minimum two rows each side.

3.4 KITCHEN EXHAUST FIRE-RATED DUCT SYSTEM INSTALLATION

.1 Ducts to be installed to the following requirements:

.1 Install as per the requirements of ULC/FRD-4 Fire Resistant Duct System for ducts intended for use in exhaust systems serving commercial and institutional kitchen appliances.

.2 Copper-coated steel insulation pins, nominal 3mm thick, minimum 102mm long, shall be stud welded to the bottom surface of steel duct on horizontal runs and on the widest surface on vertical runs of the steel duct at 305mm OC maximum.

.3 The interior layer of the duct wrap shall be installed around the duct with an overlap of minimum 76mm. The second layer of blanket shall be wrapped around the first layer with overlapping joints staggered minimum 267mm. All single and double layer joints are to be covered with minimum 102mm wide aluminum tape.

.4 The layer or duct wrap are locked into place over the insulation pins with 25mm by 25mm speed clips. Banding material, 13mm wide and minimum 0.3mm thick, shall be installed with a tensioning tool and spaced a minimum 267mm OC.

3.5 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thickness: Conform to following table:

Duct System	TIAC Material Code	TIAC Installation Code	Vapor Barrier	Thickness (mm)

Rectangular Supply Duct (A/C Systems)	C-1	CER/2	yes	25
Round Supply Duct (A/C Systems)	C-2	CEF/2	yes	25
Supply, return and exhaust ducts exposed in space being served	none			
Outside Air Ducts to HRV	C-1	CER/3	yes	40
Supply Air Ducts from ERV to OU-1	C-1	CER/2	yes	25
Exhaust Air Ducts from HRV to louvers	C-1	CER/2	yes	25
Exhaust duct between dampers and louvers	C-1	CER/3	yes	40
Kitchen Exhaust through Attic Space	Fire-wrap	N/A	N/A	*
Exhaust Duct in Attic Space	C-1	CER/1	no	50

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.3 Finishes definition:

.1 TIAC code **CRF/1** - For indoor ductwork:

.1 Rigid insulation with an integral vapour retarder. Continuous metal corner bead to all corners. Adhere vapour retarder tape over all joints and breaks in vapour retarder, and at all corners.

.2 Secure canvas jacket over insulation using fire resistive lagging coating and adhesive, and finish with one coat of fire resistive lagging coating adhesive.

.2 TIAC code **CRF/2** – For indoor ductwork:

.1 Rigid insulation with an integral vapour retarder. Apply continuous metal corner bead to all corners. Adhere vapour retarder tape over all joints and breaks in vapour retarder, and at all corners.

.3 TIAC code **CRF/3** – For outdoor ductwork:

.1 Adhere vapour retarder tape over all joints and breaks in vapour retarder and at all corners.

.2 Apply over the insulation surface a stucco embossed aluminum jacket secured with pop rivets. All joints sealed or flashed to prevent water infiltration.

.4 TIAC code **CRD/1** – Round Duct Indoor:

.1 Use flexible insulation with integral vapour retarder. At all joints and breaks, apply vapour retarder tape.

.2 Apply canvas jacket over insulation using fire resistive lagging coating and finish with one coat of fire resistive lagging coating.

.5 TIAC code **CRD/2** – Round Duct Indoor:

.1 Use flexible insulation with integral vapour retarder.

.2 At all joints and breaks, apply vapour retarder tape.

.6 TIAC code **CRD/3** – Round Duct Outdoor:

.1 Adhere vapour retarder tape over all joints and breaks in vapour retarder.

.2 Apply over the insulation surface a stucco embossed aluminum jacket secured with pop rivets. Al joints sealed or flashed to shed water.

.7 TIAC code **CRD/4** – Round Duct Outdoor:

.1 Install an aluminized modified bitumen membrane in accordance to manufacturer's instructions.

.4 Finishes: Conform to following table:

Duct System	TIAC Code	
	Rectangular Duct	Round Duct
Indoor, concealed	CRF/2	CRD/1
Indoor, exposed within mechanical spaces	CRF/1	CRD/1
Indoor, exposed elsewhere	CRF/1	CRD/1

.5 Fire-rated ductwork to be finished with stainless steel jacket.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

1.2 GENERAL

.1 Commissioning is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Commissioning is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff.

.2 Contractor assists in Commissioning process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Commissioning activities supplement field quality and testing procedures described in relevant technical sections.

.2 Commissioning is conducted in concert with activities performed during stage of project delivery. Commissioning identifies issues in Planning and Design stages which are addressed during Construction and Commissioning stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Commissioning activities includes transfer of critical knowledge to facility operational personnel.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Commissioning, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Consultant, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-COMMISSIONING REVIEW

.1 Before Construction:

.1 Review contract documents.

.1 Adequacy of provisions for Commissioning.

.2 Aspects of design and installation pertinent to success of Commissioning.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Commissioning.

.3 Before start of Commissioning:

.1 Ensure installation of related components, equipment, sub-systems, systems is complete.

.2 Fully understand Commissioning requirements and procedures.

.3 Have Commissioning documentation shelf-ready.

.4 Understand completely design criteria and intent and special features.

.5 Submit complete start-up documentation to Consultant.

.6 Have Commissioning schedules up-to-date.

.7 Ensure systems have been cleaned thoroughly.

.8 Complete TAB procedures on systems, submit TAB reports to Consultant for review and approval.

.9 Ensure "As-Built" system schematics are available.

.4 Inform Consultant in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Consultant before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

.1 Submittals: in accordance with Section 22 05 00 – Common Work Results for plumbing.

1.8 COMMISSIONING SCHEDULE

.1 Provide detailed Commissioning schedule as part of construction schedule.

.2 Provide adequate time for Commissioning activities prescribed in technical sections and commissioning sections including:

.1 Approval of Commissioning reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.9 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.10 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Contractor to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.11 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval by Consultant.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Consultant

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere herein or in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.12 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Commissioning.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System Performance Verification: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Consultant after distinct phases have been completed and before commencing next phase.

.4 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Consultant. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Consultant.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Consultant.

.3 If evaluation report concludes that major damage has occurred, Consultant shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.13 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Consultant for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Consultant to repeat start-up at any time.

1.14 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Consultant for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.15 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.16 START OF COMMISSIONING

.1 Notify Consultant at least 21 days prior to start of Commissioning.

.2 Start Commissioning after elements of building affecting start-up and performance verification of systems have been completed.

1.17 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Commissioning:

.1 Under actual or accepted simulated operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Commissioning procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.18 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Consultant within 5 days of test and with Commissioning report.

1.19 EXTRAPOLATION OF RESULTS

.1 Where Commissioning of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Consultant in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.20 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.

.2 Number and location to be at discretion of Consultant.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.5 Perform additional commissioning until results are acceptable to Consultant.

1.21 REPEAT VERIFICATIONS

.1 Assume costs incurred by Consultant for third and subsequent verifications where:

.1 Verification of reported results fail to receive Consultant's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Consultant deems Contractor's request for second verification was premature.

1.22 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Commissioning proceeds.

.2 Perform static and operational checks as applicable and as required.

1.23 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Commissioning to satisfaction of Consultant.

.2 Report problems, faults or defects affecting Commissioning to Consultant in writing. Stop Commissioning until problems are rectified. Proceed with written approval from Consultant.

1.24 COMPLETION OF COMMISSIONING

.1 Upon completion of Commissioning leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Commissioning specifications, complete Commissioning prior to issuance of Interim Certificate of Completion.

.3 Commissioning to be considered complete when contract Commissioning deliverables have been submitted and accepted by Consultant.

1.25 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Commissioning process, provide updated Commissioning form for affected item.

1.26 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.27 OCCUPANCY

.1 Cooperate fully with Owner during stages of acceptance and occupancy of facility.

1.28 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and Performance Verification if:

.1 Accuracy complies with these specifications.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.29 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.30 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Consultant will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

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 MINIMUM REQUIREMENTS

.1 Procedures proposed herein are minimum verification requirements only and do not absolve manufacturer and/or contractor of any obligations regarding quality of work and warranty of their equipment or any other obligation specified elsewhere.

3.3 START-UP OF PROPANE SYSTEM

.1 Site Tests/Inspection:

.1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

.2 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Schedule site visits to review work at stages listed:

.1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 25% and 60% complete.

.3 Upon completion of work, after cleaning is carried out.

.3 Obtain reports within 3 days of review and submit immediately to Consultant.

.4 Purging: purge after pressure test in accordance with CAN/CSA B149.1.

.5 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

.6 Performance Verification:

.1 Measure gas pressure at gas meter outlet and at burner manifold.

.2 Verify details of temperature and pressure compensation at meter.

.3 Verify settings, operation, venting of high and low pressure cut-outs, alarms.

.4 Check terminals of vents for gas pressure regulators.

.7 Cleaning: in accordance with CAN/CSA B149.1.

3.4 START-UP OF HVAC FANS

.1 General:

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start fans, check impeller rotation.

.4 Check for safe and proper operation.

.5 Test operation of hands-on-auto switch.

.6 Adjust leakage through water-cooled bearings.

.7 Adjust shaft stuffing boxes.

.8 Run-in pumps for 12 continuous hours.

.9 Adjust alignment of ducts to ensure full flexibility.

.10 Eliminate causes of excessive vibrations.

.11 Verify lubricating oil levels.

.3 Performance verification:

.1 Obtain manufacturer's approval, before performing PV, to ensure warranties remain intact.

.2 PV procedures:

.1 Verify the fan size and capacity. Capacity tests results should be evaluated in the light of the accuracy of in instrumentation and the actual conditions at the time of the test.

.2 Backdraft dampers need to be tested for proper operation. Non-motorized dampers must open and close freely without binding. Motorized dampers must be connected to the EMCS control system and verified that they are commanded open prior to fan operation.

.3 Verify that network failures do not result in unsafe operating modes. The recovery from the failure should safely return the drive to the network.

.4 Verify that drive settings and adjustments provide for safe and reliable system operation at peak efficiency levels in all operating modes.

.5 Verify that any belt drives have been adjusted and aligned.

.6 Verify all safeties, interlocks, and alarms are programmed (or hard-wired, if applicable) and function correctly, regardless of VFD operating position (i.e. hand, auto, by-pass).

.7 If necessary, verify that the motor shaft is grounded.

.8 Verify distribution system pressure drops do not exceed design expectations.

.9 Verify all VFD operating parameters are correct for the application, including acceleration and deceleration times and minimum speed setting.

3.5 PERFORMANCE VERIFICATION OF EXTERIOR LOUVERS

.1 Verify that all water penetration through louvers is drainable to the outside or to floor drains.

3.6 START-UP OF AIR TO AIR ENERGY RECOVERY EQUIPMENT

.1 General:

.1 Timing: only after TAB of air systems have been successfully completed.

.2 For fan powered equipment, do start-up of fans as per fan requirements herein.

.3 Check heat exchanger for cleanliness on supply and return sides.

.4 Check installation, location, settings and operation of operating, limit and safety controls.

.5 Have manufacturer present during start-up and certify performance.

.2 Supply and return side:

.1 Measure flow rate, outlet pressure, and either air temperature at exchanger inlet and outlet.

.2 Calculate heat transfer from supply and return sides.

.3 Heat Wheel:

.1 Verify proper rotation and controls of heat wheel

3.7 START-UP OF AIR HANDLING UNITS

.1 General:

.1 Timing: only after TAB of air systems have been successfully completed.

.2 Start-up of fans to be made as per requirements specified elsewhere in this section.

.3 Have manufacturer present during start-up and certify performance.

.2 Verify check-list prior to start-up:

.1 Unit in general:

.1 Casing is in good condition (dents, cracks, leaks?)

.2 Shipping restraints have been removed

.3 Adequate maintenance access to all components

.4 No unusual noise or vibration

.5 Electrical connections tight

.6 Air filters clean and tight fitting

.7 All dampers move freely and close tightly

.8 Thermometers, pressure gauges and wells are installed as per specification

.3 Performance verification:

.1 Obtain manufacturer's approval, before performing PV, to ensure warranties remain intact.

.2 PV procedures:

.1 General:

.1 Functional performance test: Contractor shall demonstrate operation of Air Handling Unit as per specifications.

.2 Ventilation contractor to work closely with EMCS contractor to ensure that AHU runs through entire sequence of operation without any issues.

.3 Run through PV procedures of fans as described herein.

.4 If heat exchanger is present, run through PV procedures of air to air energy recovery equipment as described herein.

.2 Check for smooth, vibration less correct rotation of supply and return fan impeller.

.3 Measure supply fan capacity.

.4 Measure pressure drop each component of air handling unit.

.5 Measure DBT, WBT of SA, RA, EA under the following conditions:

.1 Normal operation

.2 Simulated max heating load

.3 Simulated max cooling load

.6 Measure flow rates (minimum and maximum) of SA, RA, EA, relief air.

.7 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.

.8 Use smoke test to verify no short-circuiting of EA, relief air to outside air intake or to condenser intake.

.9 Simulate maximum heating load and verify temperature rise across coil.

.10 Refer to other sub-sections for PV procedures for other components.

3.8 START-UP OF HEAT PUMP

.1 General:

.1 Timing: only after TAB of air systems have been successfully completed.

.2 Start-up of fans to be made as per requirements specified elsewhere in this section.

.3 Have manufacturer present during start-up and certify performance.

.2 Verify check-list prior to start-up:

.1 Space heating and/or hot water circuits are fully installed, filled, purged and pressurised

.2 All pipes are correctly fastened

.3 Pipe penetration through outside walls are water tight.

.4 Electrical installation is correct and safe (all connections tight, etc.)

.5 Flows through air/water heat exchangers are in the correct direction

.6 All sensors are installed correctly and connected to the controller

.7 Settings of all safety devices and thermostats are correct

.8 Rotational direction of the compressor is correct and compressor running smoothly

.9 Ensure refrigerant circuit is filled and leak-free

.3 Performance verification:

.1 Obtain manufacturer's approval, before performing PV, to ensure warranties remain intact.

.2 Verify water and/or air flowrates are as per specifications

.3 Verify inlet and outlet water and/or air temperatures are as per specifications

.4 Verify refrigerant temperatures at evaporator and condenser

.5 Verify current amp and voltage indicate correct operation

.6 Verify proper function of all usage indicators and alarms

.7 Verify system is running without undue noise or vibration

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation procedures for electric heating and cooling controls.

.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Air Movement and Control Association, Inc. (AMCA).

.1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA International).

.1 CSA-C22.1-12, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in appropriate assembly.

.3 Operating conditions: 0 - 50 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 TEMPERATURE SENSOR

.1 General: to be resistance or thermocouple type to following requirements:

.1 Thermocouples: limit to temperature range of 200degrees C and over.

.2 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.3 Sensing element: hermetically sealed.

.4 Stem and tip construction: copper or type 304 stainless steel.

.5 Time constant response: less than 3 seconds to temperature change of 10 degrees C.

.2 Room temperature sensors and display wall modules.

.1 Room temperature sensors.

.1 Wall mounting, in slotted type covers having brushed stainless steel finish, with guard.

.2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2 degrees C.

2.3 ELECTROMECHANICAL RELAYS

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.

.2 Coils: rated for 120V AC or 24V DC as indicated.

.3 Contacts: rated at 5 amps at 120 V AC.

.4 Relay to have visual status indication

2.4 SOLID STATE RELAYS

.1 General:

.1 Relays to be socket or rail mounted.

.2 Relays to have LED Indicator

.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.

.4 Operating temperature range to be -20 degrees C to 70 degrees C.

.5 Relays to be CSA Certified.

.6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.

.7 Operational frequency range, 45 to 65 HZ.

.2 Input:

.1 Control voltage, 3 to 32 VDC.

.2 Drop out voltage, 1.2 VDC.

.3 Maximum input current to match AO (Analog Output) board.

.3 Output.

.1 AC or DC Output Model to suit application.

2.5 ELECTRONIC CONTROL DAMPER ACTUATORS

.1 Requirements:

.1 Direct mount proportional type as indicated.

.2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.

.4 Power requirements: 120 V AC.

.5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.

.6 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.6 WIRING

.1 In accordance with Div. 26.

.2 For wiring under 70 volts use FT4 wiring in conduits.

.3 Wiring must be continuous without joints.

.4 Sizes:

.1 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.

.2 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair.

2.7 LINE-VOLTAGE REVERSE ACTING THERMOSTAT

.1 7-day programmable thermostat with on-demand back-light digital display, double pole, to be compatible with fan.

.2 For use with 120V/1Ph line voltage.

2.8 ROOM CONTROLLER

.1 Wall mounted remote controller with a minimum of two external outputs.

.2 Capable of displaying and controlling temperature and humidity in a remote room by activating exhaust fan.

.3 Internal processor with LCD digital display.

.4 Wall mounted enclosure with keypad.

2.9 KITCHEN CONTROL PANEL

.1 General:

.1 NEMA-1 Stainless Steel Enclosure within a Stainless Steel Enclosure Panel, Printed Circuit Board (PCB), User Interface, with room temperature sensors and fan control through relays or 0-10 VDC signals. Shall be capable of controlling the exhaust and supply fans. The control system shall utilize a combined control panel and hood light power connection with 120V / 60Hz / 1Ph input voltage.

.2 The Kitchen Control enclosure shall be fitted with handled, quarter-turn, slotted latched doors.

.3 After fan initiation is triggered, the controller shall operate the associated exhaust and supply fan at their design speeds via motor starters as shown on control diagrams.

.4 Fan Proving:

.1 The control panel shall be equipped with a supply proving switch proving that the supply fan is operational within a configurable time limit before exhaust fan can operate.

.5 Damper end switch:

.1 The controller panel shall be equipped with a damper end switch, proving that the MUA-1 inlet damper is open before exhaust fan can operate.

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 equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping: provide space for fire stopping. Maintain fire rating integrity.

.6 Electrical:

- .1 Complete installation in accordance with Div.26.
- .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
- .3 Refer to control schematics included as part of control design schematics on drawings. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Engineer.
- .4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .5 Install communication wiring in conduit.
  - .1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).
  - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
  - .3 Maximum conduit fill not to exceed 40%.
  - .4 Design drawings do not show conduit layout.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Steel and FRP materials, components and installation for the outdoor and indoor distribution systems for petroleum products.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B16.11-2016, Forged Fittings, Socket-Welding and Threaded.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A48/A48M-03(2016), Standard Specification for Gray Iron Castings.

.2 ASTM A181/A181M-14, Specification for Carbon Steel Forgings, for General Purpose Piping.

.3 ASTM A193/A193M-16, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

.4 ASTM A194/A194M-17, Standard Specification for Carbon and Alloy-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

.5 ASTM A216/A216M-16, Standard Specification for Steel Castings, Carbon, Suitable For Fusion Welding, for High-Temperature Service.

.6 ASTM D2310-06 (2012), Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

.7 ASTM D2517-06(2011), Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings.

.8 ASTM D2996-15, Specification for Filament-Wound, "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Pipe.

.3 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations (Spiral-bound).

.2 CSA W47.1-09(2014), Certification of Companies for Fusion Welding of Steel Structures.

.3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.4 CSA W178.2-14, Certification of Welding Inspectors (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA B149.2-15, Propane storage and handling code

.6 CSA B137.4 - Polyethylene (PE) piping systems for gas services

.7 .CSA B137.4 - Electrofusion-Type Polyethylene Fittings for Gas Services

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 National Fire Code of Canada 2015

.6 Transport Canada/Canadian Transport Commission

.1 General Order No. 0-32, Regulations Respecting the Design, Location, Construction, Operation and Maintenance of Stationary Bulk Storage for Flammable Liquids SOR /85-472.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Indicate following:

.1 Pipe network plan.

.2 Pump house and equipment layout.

.3 Connections at distribution points.

.4 Type and location of valves, strainers, disconnect and pipe couplings.

.3 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders certified in accordance with API 1104 and CSA W47.1 and CSA W47.1S1.

.1 Assign identification number to welders.

.2 Submit records of welder's certification and test results to Consultant.

.2 Inspectors:

.1 Weld inspectors certified in accordance with CSA W178.2.

.2 Inspectors to submit records of inspections and test results to Consultant.

.2 Regulatory Requirements: work to be performed in compliance with CSA B149.1 and CSA B149.2.

1.5 SITE CONDITIONS

.1 Environmental Requirements:

.1 Safeguard natural streams, waterways and storm drainage systems from possible contamination in accordance with authority having jurisdiction.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 STEEL PIPING

.1 Pipe: to API 5L, schedule 40.

.2 Fittings: unless otherwise indicated, welding type, carbon steel, seamless or resistance weld. Wall thickness same as corresponding pipe size.

.3 Flanges: carbon steel, raised face, weld neck, to ASTM A181/A181M, Grade II Class 150, 1 MPa.

.4 Bolting materials:

.1 Bolts: carbon steel to ASTM A193/A193M.

.2 Nuts: carbon steel to ASTM A194/A194M.

.3 Gasket: capable of chemically withstanding fluids and temperatures of 650 degrees C.

.5 Joints:

.1 Aboveground: threaded joints using compound approved by Consultant for product being handled.

.2 Welded joints: to requirements of CSA W47.1 and CSA W47.1S1.

.6 Flexibility: pipelines connected to tanks, except straight fall lines and test valves:

.1 Arrange to permit tank movement.

.7 Corrosion and product protection:

.1 Protect piping against external corrosion.

2.3 POLYETHYLENE PIPING

.1 Pipe: to CSA B137.4

.2 Fittings: Electrofusion type polyethylene fittings for gas services to CSA B137.4.1.

.3 Terminate all below ground to above ground transition with listed transition risers by the same manufacturer as the PE piping system complete with all required accessories.

2.4 VALVES

.1 Steel without copper bearing alloy: to API 6D. Class 150, 1 MPa.

.2 Gate valves 50 mm and larger: to ASTM A216/A216M, Grade WCB, carbon steel, OS&Y, flanged ends.

.3 Plug valves flanged ends: Class 300, 2 MPa, bolted bonnet, tapered plug and seat, carbon steel body and trim with plug, Teflon lining.

.4 Glands and valve seats: materials resistant to conveyed fluid.

.5 Rising stem or other indicating valves: where necessary, to establish visually whether valves are open or shut.

2.5 VALVE CHAMBERS AND VALVE BOXES

.1 Covers and frames: cast grey or ductile iron to withstand distributed loading of 210 kN/m2for maximum loading of 45 tonnes per unit.

.2 Wall sleeves: to Section 23 05 00 – Common Work Results for HVAC.

.3 Ladder rungs: 22 mm diameter, galvanized steel

2.6 PRESSURE REGULATOR

.1 Second Stage Pressure Regulator

.1 Constant pressure type, ductile iron, with ss trim.

.2 Size and capacity: 162 kW @ 35 kPa (5psig) inlet pressure and 2.7 kPa (11 in W.G) outlet pressure.

.3 Basis of design: Fisher CS800IR or approved equal.

2.7 PRESSURE GAUGES

.1 Pressure Gauges: to Section 23 05 19 - Thermometers and Pressure Gauges for HVAC Piping.

.2 Scale markings: 0 to 2.0 kPa.

2.8 ANCHORS AND GUIDES

.1 As per CSA B149-1.

2.9 PROVISIONS FOR EXPANSION

.1 As per CSA B149-1.

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 PIPING

.1 Install in accordance with Section 23 05 01 - Installation of Pipework, applicable Provincial/Territorial Codes, CAN/CSA B149.1, supplemented as specified.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.3 HANDLING

.1 Protect and shield pre-coated equipment and piping.

3.4 COATINGS

.1 Clean surfaces to base metal. Store clean pipe for short time period in sheltered dry location.

.2 Shop application; prefabricated piping sections are limited to 15 m maximum length.

.3 Reprime mill primed pipe before coating.

.4 Coating: to manufacturer's recommendations.

3.5 ANCHORS AND GUIDES

.1 Install anchors and guides as indicated and at following points:

.1 Connections to storage tanks.

.2 At changes of pipe sizes.

.3 At branch line take offs.

.4 At changes of piping directions.

.5 At terminal points.

.6 Elsewhere as indicated.

3.6 PROVISION FOR EXPANSION

.1 Install loops and offsets as indicated.

3.7 SUPPORTS

.1 Above-ground piping: prevent excessive vibration and stress on adjacent equipment.

3.8 PROTECTION

.1 Protect piping system from damage by vehicular traffic using guard devices, marked with fluorescent markers or painted with warning colours.

3.9 SLEEVES

.1 Install where pipes pass through walls or floors. Firestop around pipes.

3.10 LOCATION OF PIPEWORK

.1 General: locate not to constitute hazard to personnel, buildings or equipment.

3.11 INDOOR INSTALLATION

.1 Install to approval of authority having jurisdiction.

.2 Take most direct route possible or practicable.

.3 Support overhead or locate in trenches which contain no other services.

.4 Install overhead piping close to ceiling or beams or along walls, where possible. Support from building structure at least 1800 mm from floor.

.5 Steel frame buildings: use bolted clips or pipe hangers attached to flanges with retaining strap.

.6 Concrete ceilings: use through bolts or poured-in-place expansion shields.

.7 Hanger spacing:

.1 Up to NPS11/4, 3700 mm.
.2 NPS 1 1/2 and over, 4600 mm.
.3 Design to prevent lateral movement.

.8 Exposed risers: protect against mechanical damage by installing:

.1 Adjacent to walls or pilasters.
.2 Between flanges of steel columns.
.3 Guards.

.9 Pipework above floor level inside buildings from above-ground outdoor storage tanks: cover with "anti-sweat" insulation.

.10 Install loops or swing connections to compensate for pipe movement.

.11 Install heating systems for piping systems in accordance with Part 4 of the National Fire Code of Canada, subsection 4.4.9, "Heating of Piping Systems".

.12 Do not jeopardize fireproofing of structural elements or fire separations.

3.12 VALVES

.1 Install valves to control flow and to isolate equipment at following locations:

.1 Loading and unloading connections;

.2 Fill and withdrawal connections of above-ground tanks;

.3 Upstream of liquid level control valves or fill lines to underground tanks;

.4 Branch lines at points of connection to main line;

.5 Suction and discharge of pumps:

.6 At equipment requiring periodic servicing such as filters, metres and automatic equipment.

.2 Install valves with stems upright or horizontal unless otherwise approved by Consultant.

.3 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.13 WELDING

.1 Do work in accordance with API 1104, and Section 23 05 17 - Pipe Welding.

3.14 COMMISSIONING

.1 Commission system to Section 23 08 00 – Commissioning for HVAC.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A480/A480M-16b, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).

.1 NFPA 90A-15, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-15, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-17, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction, 2007.

.4 SMACNA Duct Cleanliness for New Construction - 2000

.7 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common work Results for HVAC.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

2.2 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
To 500	A
500 to 2500	A

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant and tape.

.3 Class C: transverse joints and connections made air tight with sealant and tape. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.3 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

.2 For maximum pressure above 500 Pa, use high velocity duct sealing compound.

2.4 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.5 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Fire stopping material and installation must not distort duct.

2.6 LOW PRESSURE DUCTWORK TO 500 Pa

.1 Galvanized Steel

.1 Lock forming quality: to ASTM A653/A653M, Z275 (G90) zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Joints: to SMACNA HVAC Duct Construction Standards Metal and Flexible or proprietary manufactured duct joint.

.1 Acceptable material: Ductmate or approved equal.

.2 Fittings

.1 Fabrication: to SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Radiused elbows.

.1 Rectangular: standard radius or short radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.

.2 Round: smooth radius or five piece (for 90 degrees) or three piece (for 45 degrees). Centreline radius: 1.5 times diameter unless noted otherwise.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Short radiused elbows or as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.7 KITCHEN EXHAUST SYSTEMS

.1 Construct in accordance with NFPA 96.

.2 Material: steel sheet.

.3 Thickness: 1.37 mm.

.4 Fabrication: Liquid tight externally welded.

.5 Reinforcement: as per requirements of ASHRAE and SMACNA.

.6 Access doors: Provide high temperature grease duct access doors that meat NFPA 96 standards above the hood exhaust duct collar and as required by local authority having jurisdiction and for access to the fire suppression system.

.1 Acceptable material: Kees Incorporated, Ductmate Canada or approved equal.

.7 Clearences: As per NFPA 96 and the following:

.1 minimum clearance shall be provided:

.1 475mm to combustible material

.2 75mm to limited combustible material

.3 0 mm to non-combustible material

.2 These minimum clearances shall be approved by local Fire Marshall before installation.

2.8 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: black steel angle with black steel rods to following table:

Duct Size (mm)	**Angle Size (mm)**	**Rod Size (mm)**
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps.

.4 Do not attach to lower cord of steel joist.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with ASHRAE and SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 DUCT SCHEDULE

.1 HVAC Ventilation systems indoor ductwork: Low Pressure Galvanized Steel

3.3 HANGERS

.1 Band hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Upper attachments and rods as per section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.4 Hanger spacing: in accordance with SMACNA or as follows:

Duct Size	**Spacing**
(mm)	**(mm)**
to 1500	3000
1501 and over	2500

3.4 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Solder or weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards hoods served.

.1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 20 mm drain connected, with deep seal trap and trap primer and discharging to open funnel drain or as indicated.

3.5 DUCT LEAKAGE TEST

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial test has been passed.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete test before performance insulation or concealment Work.

3.6 KITCHEN EXHAUST SYSTEMS

.1 Install to NFPA 96 and as indicated.

.2 Kitchen exhaust hoods shall have a minimum clearance of 457mm to combustible materials and 76mm to limited combustible materials.

.3 Provide for any and all access panels (openings) as described in NFPA 96.

3.7 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.8 DUCT CLEANLINESS FOR NEW CONSTRUCTION

.1 All ducts being installed in new construction shall follow the guidelines of SMACNA's Duct Cleanliness for New Construction.

.1 Level of cleanliness to achieve: Basic Level.

.2 Those requirements include, but are not limited to:

.1 Ductwork leaving the premises of the manufacturer will include the following:

.1 Internal and/or external self-adhesive labels or makings for part identification,

.2 exposed mastic sealant,

.3 light zinc oxide coating on the metal surface,

.4 a light coating of oil on machine formed ductwork

.5 minor protrusions into the airway of rivets, screws, etc.

.6 internal insulation and associated fasteners (when required)

.2 Unless otherwise specified, ductwork delivered from the premises of the manufacturer will have no protection. However, care must be taken to prevent damage during transportation and offloading.

.3 Site storage to be in a clean and dry environment and exposure to dust minimized.

.4 Installation:

.1 Individual duct sections must be inspected to ensure that they are free from all debris prior to installation.

.2 All risers must be covered to prevent the entry of debris into the duct.

.3 Downward facing and horizontal openings will not be required to be covered.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

1.2 SUBMITTALS

.1 Submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's Field Reports: manufacturer's field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.3 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 1.5 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2.

2.4 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks.
.2 301 to 450 mm: four sash locks.
.3 451 to 1000 mm: piano hinge and minimum two sash locks.
.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
.5 Hold open devices.

2.5 TURNING VANES

.1 Factory or shop fabricated double thickness without trailing edge, to recommendations of SMACNA and as indicated.

2.6 INSTRUMENT TEST PORTS

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.7 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

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 data sheet.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 Inlets and outlets of modular of manufactured ventilation units (AHUs, ERVs, etc.), including fresh air and exhaust air connections.

.4 As indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 600 x 600 mm for person size entry.

.2 300 x 300 mm for servicing entry.

.3 100 x 100 mm for viewing.

.4 As indicated.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Consultant.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning vanes:

.1 Install in any rectangular ductwork which does not meet the 1.5x turning radius requirement.

.2 Install in accordance with recommendations of SMACNA and as indicated.

3.3 COMMISSIONING

.1 Refer to section 23 08 00 – Commissioning for HVAC.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2005.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 GENERAL

.1 Manufacture to SMACNA standards.

2.3 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm.

.4 Bearings: pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

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 where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 90A-2015, Installation of Air Conditioning and Ventilating Systems.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S112-10, Fire Test of Fire Damper Assemblies.

.2 CAN4-S112.2- 07, Fire Test of Ceiling Firestop Flap Assemblies.

.3 ULC-S505- 1974, Fusible Links for Fire Protection Service.

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Indicate the following:

.1 Fire dampers.

.2 Smoke dampers.

.3 Fire stop flaps.

.4 Operators.

.5 Fusible links.

.3 Provide maintenance data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Provide following:

.1 2 fusible links of each type.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 FIRE DAMPERS

.1 Fire dampers: arrangement Type A, B or C, listed and bear label of ULC, meet requirements of provincial fire authority. Fire damper assemblies to be fire tested in accordance with CAN4-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.

.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; roll door type; guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

.11 Acceptable material: NCA, Ruskin, Nailor, Controlled Air, Air Management Inc. (AMI), E.H. Price, LAU, Alumavent or approved equal.

2.3 "OUT-OF-WALL/FLOOR" TYPE FIRE DAMPERS

.1 Fire dampers: arrangement Type A, B or C, listed and bear label of ULC, meet requirements of provincial fire authority. Fire damper assemblies to be fire tested in accordance with CAN4-S112. Fire damper to be tested and approved for "out-of-wall/floor" application, for installation as shown on drawings.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated (Refer to architectural drawings).

.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; roll door type; guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed outside of centerline of wall/floor according to details on drawings, not to exceed distance as recommended by manufacturer.

.10 Unless otherwise indicated, the installation details given in manufacturer's instructions for fire dampers shall be followed.

.11 Acceptable material: Greenheck, NCA, Ruskin, Nailor, Controlled Air, Air Management Inc. (AMI), E.H. Price, Alumavent or approved equal.

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 fire and smoke damper installation in accordance with manufacturer's written instructions.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Duct Accessories.

.5 Coordinate with installer of firestopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

3.4 COMMISSIONING

.1 Refer to section 23 08 00 – Commissioning for HVAC.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of flexible ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 National Fire Protection Association (NFPA).

.1 NFPA 90A-15, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-15, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - 2005.

.2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 2007.

.4 Underwriters' Laboratories Inc. (UL).

.1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S110, Fire Tests for Air Ducts.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.4 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 **Type 1**: spiral wound flexible aluminum, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

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 flexible ducts installation in accordance with manufacturer's written instructions.

3.2 DUCT INSTALLATION

.1 Install in accordance with: SMACNA and NFPA 90A.

.2 Install every supply diffuser in suspended ceiling area with flexible ductwork.

.3 Maximum length of flexible ducts shall be 1.5 m.

3.3 FLEXIBLE DUCT SCHEDULE

.1 Air conditioned supply diffusers and grilles: Type 2

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99-2003, Standards Handbook.

.2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Office des normes générales du Canada (CGSB)

.1 CAN/CGSB 1.181-99, Enduit riche en zinc, organique et préparé.

.4 Santé Canada/Système d'information sur les matières dangereuses utilisées au travail (SIMDUT)

.1 Fiches signalétiques (FS).

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common Work Results for HVAC.

.3 Provide :

.1 Fan performance curves showing point of operation, kW and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers as appropriate.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.

1.3 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 23 05 00 – Common Work Results for HVAC.

.1 Spare parts to include:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedules found on drawings shall be considered as being integral part of these specifications. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

.4 If any model other than numbered item is supplied, Consultant retains the right to refuse any fan if he/she deems that system’s position on fan curve is not acceptable.

2.2 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

2.3 FANS GENERAL

.1 Motors:

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC supplemented as specified herein.

.2 For use with variable speed controllers as required.

.3 Sizes as indicated.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail, motor bases, belt guards, coupling guards fan inlet and outlet safety screens as indicated and as specified in Section 23 05 00 – Common Work Results for HVAC, dampers and vanes are as indicated.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.6 Vibration isolation: to Section 23 05 48 – Vibration and Seismic Controls for HVAC.

.7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.4 MAKE UP AIR UNIT

.1 General Description:

.1 Gas-Fired heating make up air unit for rooftop outdoor installation.

.2 Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

.3 Unit with Integral Heating shall be fully assembled at the factory and consist of an insulated metal cabinet, outdoor air intake weather hood with bird screen curb assembly, service receptacle, filter assembly for intake air, supply air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

.2 Cabinet:

.1 Materials: Formed, single wall metal cabinet with fiberglass duct liner insulation fabricated to permit access to internal components for maintenance.

.2 Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish.

.3 Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181

.3 Supply Fan:

.1 Forward curve blower: Blower assembly consists of an electric motor and a belt driven, double width, and double inlet forward curve blower. Assembly shall be mounted on heavy gauge galvanized rails.

.4 Direct Fired Burner:

.1 Unit shall be factory assembled, piped and wired. Direct gas-fired system with an efficiency of 90%or more while supplying a burner that is capable of providing a minimum of 25:1 turndown.

1. Shall include the following safety controls:
   .1 Manual Reset, High Limit Switch
   .2 Dual safety shutoff valves shall be that do not exceed 120 VAC control signals.
   .3 High and low Gas Pressure Switches
   .4 Clear visual signal demonstrating the position of the main gas safety shutoff valves.

2.5 ROOF CENTRIFUGAL EXHAUST FAN

.1 General Description:

.1 Upblast fan shall be for roof mounted applications
.2 Maximum continuous operating temperature to 82.2^{o}C
.3 Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.
.4 To NFPA 96 Requirements.

.2 Wheel:

.1 Constructed of aluminum
.2 Non-overloading, backward inclined centrifugal
.3 Statically and dynamically balanced in accordance to AMCA Standard 204-05
.4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

.3 Shafts and Bearings:

.1 Fan shaft shall be ground and polished solid steel with an anti corrosive coating
.2 Permanently sealed bearings or pillow block ball bearings
.3 Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
.4 Bearings are 100 percent factory tested.
.5 Fan Shaft first critical speed is at least 25 percent over maximum operating speed.

.4 Housing:

.1 Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum.
.2 Shroud shall have a integral rolled bead for extra strength.
.3 Shroud shall be drawn from a disc and direct air upward.
.4 Curb cap shall have pre-punched mounting holes to ensure correct attachment.
.5 Rigid internal support structure.
.6 Leak proof

.5 Housing Supports and Drive Frame:

.1 Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators

.6 Vibration Isolation:

.1 Refer to section 23 05 48 – Vibration and Seismic Controls for HVAC.

.7 Disconnect Switches:

.1 NEMA rated: 4
.2 Positive electrical shut-off
.3 Wired from fan motor to junction box installed within motor compartment

.8 Drive Assembly

.1 Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
.2 Belts: Static free and oil resistant
.3 Pulleys: Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts
.4 The motor pulley shall be adjustable for final system balancing
.5 Readily accessible for maintenance

.9 Options/Accessories:

.1 Birdscreen:
.1 Material Type: Aluminum
.2 Protects fan discharge
.2 Heat Baffle
.3 Hinges
.4 Grease trap
.5 Roof Curbs:
.1 As indicated on drawing.
.2 Insulated
.3 Galvanized curb extension
.6 Curb Seal:
.1 Rubber seal between the fan and the roof curb
.7 Dampers:
.1 Type: Motorized
.2 Prevents outside air from entering back into the building when fan is off
.3 Balanced for minimal resistance to flow
.4 Galvanized frames with prepunched mounting holes
.8 Finishes:
.1 Types: Baked Enamel, color to Architect’s directions.

.10 Acceptable material:

.1 Basis of design: Refer to schedules on drawings.

.2 Other acceptable manufacturers: Greenheck, Trane, Fantech, Loren Cook, ACME, Spring Air, Twin City Fans, or approved equal.

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 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

3.4 COMMISSIONING

.1 Refer to section 23 08 00 – Commissioning for HVAC.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.2 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.4 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

2.3 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: standard unless stated otherwise.

2.4 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

.2 **Type B1**: Square Cone Supply Diffuser, 3 cones.

.1 Diffusers shall consist of a precision formed back cone of one-piece seamless con-struc-tion that incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.

.2 The diffuser shall integrate with all duct sizes shown on the plans without affecting the face size and appearance of the unit.

.3 An inner cone assembly shall consist of 3 cones which drop below the ceiling plane to assure optimal VAV air diffusion performance. The inner cone assembly shall be completely removable from the diffuser face to allow for full access to any dampers or other ductwork com-pon-ents located near the diffuser neck.

.4 Finish shall be B12 white powder coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.5 Face Dimensions: **610mm x 610 mm**

.6 Acceptable material:

.1 Basis of Design: Price 610x610/SCD/31/C3/B12

.7 Other acceptable material: Nailor, Titus, Tuttle and Bailey, Krueger or approved equal.

.3 **Type B2**: Square Cone Supply Diffuser, 3 cones c/w APF Frame

.1 Diffusers shall consist of a precision formed back cone of one-piece seamless con-struc-tion that incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.

.2 The diffuser shall integrate with all duct sizes shown on the plans without affecting the face size and appearance of the unit.

.3 An inner cone assembly shall consist of 3 cones which drop below the ceiling plane to assure optimal VAV air diffusion performance. The inner cone assembly shall be completely removable from the diffuser face to allow for full access to any dampers or other ductwork com-pon-ents located near the diffuser neck.

.4 Finish shall be B12 white powder coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.5 Face Dimensions: **600 mm x 600 mm**

.6 Acceptable material:

.1 Basis of Design: Price 600x600/SCD/31/3C/B12

.2 Other acceptable material: Nailor, Titus, Tuttle and Bailey, Krueger or approved equal.

.4 **Type B3**: Square Cone Supply Diffuser, 3 cones.

.1 Diffusers shall consist of a precision formed back cone of one-piece seamless con-struc-tion that incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.

.2 The diffuser shall integrate with all duct sizes shown on the plans without affecting the face size and appearance of the unit.

.3 An inner cone assembly shall consist of 3 cones which drop below the ceiling plane to assure optimal VAV air diffusion performance. The inner cone assembly shall be completely removable from the diffuser face to allow for full access to any dampers or other ductwork com-pon-ents located near the diffuser neck.

.4 Finish shall be B12 white powder coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.5 Face Dimensions: **305mm x 305 mm**

.6 Acceptable material:

.1 Basis of Design: Price 305x305/SCD/31/C3/B12

.7 Other acceptable material: Nailor, Titus, Tuttle and Bailey, Krueger or approved equal.

.5 **Type B4**: Perforated Ceiling Return

.1 Diffuser shall consist of a perforated air distribution face of no less than 51% free area, a heavy gauge steel backpan with round / square inlet collars as noted on plans.

.2 The perforated face shall be removable from the diffuser face and shall be fitted with hinges to facilitate the removal of face screen for cleaning purposes. The perforated face screen shall be aluminum.

.3 The finish of the diffuser shall be B12 White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.4 Face Dimensions: **610 mm x 610 mm**

.5 Acceptable Material:

.1 Basis of Design: Price 610x610/PDDR/1/B12

.6 **Type B5**: Perforated Ceiling Return, ducted, round neck

.1 Diffuser shall consist of a perforated air distribution face of no less than 51% free area, a heavy gauge steel backpan with round / square inlet collars as noted on plans.

.2 The perforated face shall be removable from the diffuser face and shall be fitted with hinges to facilitate the removal of face screen for cleaning purposes. The perforated face screen shall be aluminum.

.3 The finish of the diffuser shall be B12 White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.4 Face Dimensions: **305 mm x 305 mm**

.5 Acceptable Material:

.1 Basis of Design: Price 305x305/PDDR/1/B12

.7 **Type B6**: Perforated Ceiling Return, ducted, square neck

.1 Diffuser shall consist of a perforated air distribution face of no less than 51% free area, a heavy gauge steel backpan with round / square inlet collars as noted on plans.

.2 The perforated face shall be removable from the diffuser face and shall be fitted with hinges to facilitate the removal of face screen for cleaning purposes. The perforated face screen shall be aluminum.

.3 The finish of the diffuser shall be B12 White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.4 Face Dimensions: **305 mm x 305 mm**

.5 Acceptable Material:

.1 Basis of Design: Price 305x305/PDDR/1/B12

.8 **Type G1**: Spiral Duct Supply Grille

.1 The mounting frame shall be supplied with countersunk screw holes.

.2 Open cell foam insulation gasket shall be provided around the grille neck to provide a tight seal around openings in the duct.

.3 The outlet shall be provided with an adjustable air scoop to direct airflow from the duct into the grille and to provide air volume control.

.4 The grille shall be finished in **B12 White Powder Coat**. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.5 Acceptable Material:

.1 Basis of Design: Price 406X100/SDGE/A/AS/B12

.2 Other acceptable material: Nailor, Titus, Tuttle and Bailey, Krueger or approved equal.

.9 **Type G2**: Wall Mounted Return Grille

.1 Grilles shall be **45 degree** deflection fixed louver type with blades spaced **19 mm** on center.

.2 The blades shall run parallel to the **long** dimension of the grille.

.3 The grille shall be finished in **B12 White Powder Coat**. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.4 Face Dimensions: As shown on drawings

.5 Acceptable Material:

.1 Basis of Design: Price 530D/F/L/A/B12

.2 Other acceptable material: Nailor, Titus, Tuttle and Bailey, Krueger or approved equal.

.10 **Type G3:** Fire-Rated Transfer Door Grille

.1 Grilles shall be **45 degree deflection** fixed louver type with blades **spaced 19 mm on center.**

.2 The blades shall run parallel to the **long** dimension of the grille.

.3 The grille shall be finished in **B12 White Powder Coat**. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

.1 Basis of Design: Price 61DGD-FR

.2 Other acceptable material: Nailor, Titus, Tuttle and Bailey, Krueger or approved equal.

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 manufacturers instructions.

.2 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.

.4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere as indicated.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)

.1 ANSI/NFPA 96-17, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.5 Society of Automotive Engineers (SAE)

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.2 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

.3 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: factory applied enamel. Colour: to Architect’s approval.

.9 Acceptable material:

.1 Basis of design: Refer to schedules on drawings.

.2 Other acceptable manufacturers: Carnes, E.H. Price, Greenheck, Ventex, Ruskin, Trolec, or approved equal.

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 louvres, intakes and vents installation in accordance with manufacturer's written instructions.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.4 COMMISSIONING

.1 Refer to section 23 08 00 – Commissioning for HVAC.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)

.1 ANSI/NFPA 96-17, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 TYPE I HOOD (GREASE HOODS)

.1 Baffle Filter Canopy Hood, Wall Style, Exhaust Only with Single Wall Front

.1 Kitchen Ventilation hood(s) shall be of the Type I, exhaust only wall canopy suitable for all types of cooking applications. The hood(s) shall be U. L. 710 Listed without fire damper for 400°F, 600°F, or 700°F rated cooking appliances.

.2 Make-up air shall be independently provided.

.3 Construction:

.1 The hood(s) exterior shall be constructed of a minimum of 18 gauge stainless steel with an embossed finish (430 SS), if 300 series SS is required, a #4 polished finish is to be provided.

.2 The hood(s) shall be constructed using the standing seam method for optimum strength. Front panels shall be of single wall construction.

.3 An integral 3 inch air space is provided to meet NFPA 96 clearance requirements against limited combustible walls. Integral 3 inch air space may be omitted for non-combustible construction.

.4 All seams, joints and penetrations of the hood enclosure shall be welded and/or liquid tight. Lighter material gauges, alternate material types and finishes are not acceptable.

.5 All unexposed interior surfaces shall be constructed of a minimum 18 gauge corrosion resistant steel including, but not limited to ducts, plenum, and brackets.

.4 The hood(s) shall include a filter housing constructed of the same material as the hood. The filters shall be aluminum baffle type (stainless optional), U. L. 1046 Classified, and in sufficient number and sizes to ensure optimum performance. The filter housing shall terminate in a pitched, full length concealed grease trough which shall drain into a removable grease container.

.5 The hood(s) shall include a Performance Enhancing Lip (PEL) to improve capture efficiency by turning air back into the hood.

.6 Vapor proof, U. L. Listed incandescent light fixtures shall be pre-wired to a junction box located at the top of the hood for field connection. Wiring shall conform to the requirements of the National Electrical Code.

.7 The canopy hood(s) shall be built in accordance with National Fire Protection Association (NFPA) Bulletin #96. The hood manufacturer shall provide, on request, the necessary data that confirms compliance with the code authorities listed above.

.8 Acceptable material:

.1 Basis of design: Refer to schedules on drawings.

.2 Other acceptable manufacturers: Greenheck, CaptiveAire, Provent HCE or approved equal.

.9 Hood to be supplied with stainless steel Backslpash Panel, to be confirmed on-site prior to ordering.

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 kitchen hood installation in accordance with manufacturer's written instructions.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations, and as per NFPA 96.

.2 Install Type I Grease Hood with wet chemical extinguishing system (supplied and installed by Div. 21).

3.4 COMMISSIONING

.1 Refer to section 23 08 00 – Commissioning for HVAC.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials, components and installation for heat reclaim devices.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 84-2013, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 23 05 00 – Common Work Results for HVAC.

.3 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

.4 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.

.5 Certificates:

.1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

1.4 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

Part 2 Products

2.1 GENERAL

.1 Comply with ASHRAE 84.

2.2 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.3 AIR TO AIR FIXED PLATE EXCHANGER (HRV)

.1 Unit shall include white, baked on, polyester pre-painted 20 gauge galvanized steel package. Cabinet shall withstand 10 years without chipping, peeling, brazing or spotting. Flat plate heat exchanger section shall be easily removable from the unit. Rugged polupropylene flat plate heat exchanger designed for general purpose or corrosive applications.

.2 Heat transfer surfaces.

.3 Cross contamination: not permitted.

.4 Condensate drain: 50mm.

.5 Main access panel shall be hinged and provide access to all components.

.6 Performance characteristics: Refer to drawing schedule.

.7 Acceptable material:

.1 Basis of design: Refer to schedules on drawings.

.2 Other acceptable material: Venmar CES, Nutech Lifebreath, Fantech, Nu-Air, Aéromatic or approved equal.

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 energy recovery equipment installation in accordance with manufacturer's written instructions.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

.3 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers.

.4 Pipe drain pans to closest floor or hub drain with minimum 300 mm P-trap, with minimum 50 mm difference in length between two legs of P-trap unless noted otherwise.

3.4 COMMISSIONING

.1 Refer to Section 23 08 00 – Commissioning for HVAC

END OF SECTION

PART 1 General

1.1 SCOPE OF WORK

.1 The requirements herein are applicable to electrical division 26, 27 and 28

.2 The electrical contractor shall furnish all labour, materials, tools, appliances and equipment necessary to entirely complete and provide for the operation of the electrical systems indicated in these specifications and as shown on drawings.

1.2 DEFINITIONS

.1 Refer to TIA/EIA-598, Annex A for definitions of terms: optical-fiber interconnects distribution and breakout cables.

.2 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 WORK INCLUDED IN DIV. 26, 27 AND 28

.1 The overall intention is to provide a finished piece of work complete in all aspects, and all items reasonably inferable as called for by the plans and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be specifically mentioned. This contractor shall fulfill his obligation and not take advantage of any unintentional errors or omissions should such exist, to the detriment of the owners' interest. Generally the work includes, but is not limited to the following:

.1 Electrical:

.1 Coordination with utilities, all associated fees to extend utility to building shall be borne by Owner/User;

.2 Coordination, supply and installation of conduits and wiring from new NB Power transformer bank pole to two new building service entrance;

.3 Supply and installation of exterior luminaires and their controls;

.4 Supply and installation of electrical distribution system as indicated;

.5 Wiring of equipment supplied by others including mechanical systems and building service equipment;

.6 Supply and installation of wiring devices;

.7 Supply and installation of interior luminaires and their controls;

.8 Supply and installation of emergency lights;

.9 Supply and installation of conduit and wiring;

.10 Supply and installation of electric heating and associated controls;

.11 Supply and installation of the following Communication systems:

.1 Data/Voice system;

.12 Supply and installation of the following Safety and Security systems:

.1 Intrusion Detection and Alarm system;

.2 Camera Surveillance (CCTV) system;

.3 P.A system;

.13 Supply and installation of Grounding system;

.14 Supply, installation and programming of controls as indicated;

.15 Supply and installation of wiring for baseball lighting system (system and lights supplied by owner). Contractor must also be present for commissioning. Commissioning agent will be hired by owner.

.16 Testing of systems for acceptance by inspection authority;

.17 Supply of temporary lighting and power;

.18 Mark-up “Records Drawings” in red on print provide to Consultant.

1.4 WORK NOT INCLUDED IN DIV. 26, 27 AND 28

.1 Excavation and backfill work shall be the responsibly of the General Contractor.

.2 Supply and installation of mechanical equipment shall be the responsibility of mechanical division.

.3 All architectural finishes, core drilling, cutting, and patching shall be the responsibility of the general contractor.

.4 Any required trenching of floors or removal of existing T-bar ceilings for the running of conduit or cables shall be the responsibility of the General Contractor.

.5 Firestopping of penetrations through walls and floors shall be the responsibility of the general contractor in accordance with Section 26 00 10 – Electrical Installations General Requirements.

PART 2 Products

2.1 NOT USED

PART 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Contractor shall be responsible to coordinate the enclosed applicable sections of these specifications with the following:

.1 Section 01 11 10 – General Requirements

.2 Section 07 84 00 – Fire Stopping.

.3 Section 01 23 10 – Alternates.

.4 Section 01 61 00 – Common Product Requirements

.5 Section 01 35 29 – Health and Safety Requirements.

.6 Section 01 78 00 – Closeout Submittals.

.7 Section 01 45 00 – Quality Control.

.8 Section 02 81 01 – Hazardous Materials.

.9 Section 01 74 11 – Cleaning

.10 Section 01 33 00 – Submittal Procedures.

.11 Section 31 23 33 – Excavating, Trenching and Backfilling

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, latest revision, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN/CSA-C22.3 No. 1-, latest revision, Overhead Systems.

.3 CAN/CSA-C22.3 No. 7-, latest revision, Underground Systems.

.4 CAN3-C235, latest revision, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.5 CAN/CSA Z462-latest revision, Workplace Electrical Safety.

.6 CAN/ULC-S1001-latest revision, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1, latest revision, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122, latest revision, The Authoritative Dictionary of IEEE Standards Terms.

.4 Canadian Commission on Building and Fire Codes National Research Council of Canada

.1 National Building Code of Canada – Latest revision.

.2 National Fire Code of Canada – Latest revision.

1.3 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 GENERAL REQUIREMENTS

.1 This Section covers items common to Sections of Division 26. This section supplements the requirements of Division 1 and Mechanical.

.2 All wiring and conduit are shown in diagrammatic form only. See architectural drawings for exact location of all walls and openings.

.3 Contractor shall be familiar with building ceiling spaces. Most conduit runs shown as straight runs will consist of several offsets due to service equipment. Contractor may propose alternate paths to achieve similar aims after detailed review of site conditions.

.4 Schedule all electrical work with general contractor and user. All work shall be performed in such a manner as to affect minimal disruption to the occupants. Any disruptive work shall be scheduled during the night or on weekends.

.5 Coordinate any power shut down with owner/user 72 hours in advance.

.6 Contractor shall coordinate inspection date with Consultant and shall provide labour for access to all equipment for inspection to confirm work method. Such access shall include removal of panel covers and opening of disconnect switches, junction/pull boxes, starters and luminaries.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action and informational submittals: in accordance with Division 01. All inquires, shop drawings, request for substitutions and similar items shall be submitted to the Consultant.

.2 Product Data: submit WHMIS MSDS

.3 Submit to Technical Inspection Services, Department of Public Safety, necessary number of drawings and specifications for examination and approval prior to commencement of work. Pay all associated fees.

.4 Submit for review single line electrical diagrams. Final diagrams are to be provided under plexiglass and be securely mounted to wall in the following locations:

- .1 Electrical distribution system in main electrical room.
- .2 Electrical power generation and distribution systems in power plant rooms.

.5 Shop drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in province having jurisdiction.
- .2 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures
- .3 Part numbers for submitted products and equipment to be clearly highlighted, boxed or arrowed with all required accessories and components indicated.

.4 Submitted information must be specific, detailed and relevant to the project. Bulk, generic information is not acceptable.

.5 Indicate details of construction, dimensions, capacities, and electrical performance characteristics of equipment or material.

.6 Where applicable, include wiring, single line and schematic diagrams.

.7 Include wiring drawings or diagrams showing interconnection with work of other Sections.

.8 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.9 Identify circuit terminals on wiring diagrams and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.10 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.11 Faxes are not acceptable for shop drawings. If sent by fax, they will not be reviewed.

.12 Electronic PDF shall be acceptable for preliminary review of shop drawings. Official shop drawings shall be sent as per Section 01 33 00 – Submittal Procedures.

.13 Do not begin fabrication until shop drawings have been reviewed by Consultant. Allow ten (10) working days for Consultant review.

.14 Consultant review of shop drawings does not relieve the contractor of the responsibility for co-ordination of field measurements required to complete the work.

.15 Div. 26 Contractor and General Contractor shall approve all shop drawings by signing and dating them prior to submitting to Consultant. Failure to comply will result in automatic rejection of shop drawings. When non-compliance results in extra costs due to construction delays, the contractor shall bear these costs.

.16 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.6 Electronic shop drawings:

.1 Where the use of electronic shop drawings has been agreed to by the Engineer-Architect, the following electronic submittal requirements are to be followed:

.1 Shop drawings to be submitted in PDF format, legible and clear.

.2 Shop drawings to be grouped by specification section, with one PDF file per specification section. The file name to indicate the section number and name, i.e. “26 50 00 Lighting Rev0.PDF” with resubmissions appended Rev1, Rev2, etc.

.3 Supplemental information not previously submitted to be identified as follows: “26 50 00 Lighting Supplement 1.PDF”, Supplement 2, etc.

.4 A cover sheet is to be incorporated into each PDF submission and indicate the project name and number, specification section number and name, the contractor’s name, supplier’s name, date submitted, contractor’s stamp and signature identifying that the contractor has reviewed the information prior to submission for correctness and

completeness. Sufficient white space (minimum of ¼ page) is to be left for the Engineer-Architect's stamp and comments.

.5 Part numbers for submitted products and equipment to be clearly highlighted, boxed or arrowed with all required accessories and components indicated.

.6 Submitted information must be specific, detailed and relevant to the project. Bulk, generic information is not acceptable.

.7 Electronic shop drawing transmittal forms, where provided, must be submitted as separate PDF files and not bound in with the shop drawings.

.7 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 – FIELD QUALITY CONTROL.

.8 Permits, fees and inspections

.1 Submit in accordance with Division 01 – General Requirements.

.2 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.3 Pay associated fees.

.4 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost (only for service entrance with ampacity lower than the limits set for plan review requirements).

.5 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.6 Obtain wiring permit prior to commencing work.

.7 Advise Consultant 72 hours in advance for all inspections required. This includes, but is not limited to, open ceiling, open wall, substantial, final and additional inspections as requested in following technical sections.

.8 Manufacturer's Field Reports: submit manufacturer's written report to Engineer-Architect within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 SYSTEM STARTUP

.1 Instruct Consultant-Architect and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

1.7 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 the 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 procedure.
- .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 in laminated plastic.

.4 For operating instructions exposed to weather, provide weather-resistance materials or weatherproof enclosure.

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

1.8 SITE VISIT

.1 Prior to tender submission, visit the site and become familiar with the job and all conditions which may affect the costs. Ignorance of existing conditions will not be considered as basis for extra claims.

1.9 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule and model numbers found on drawings shall be considered as being integral part of these specifications. Model number identified is the basis of design. Any model number not found shall only be considered as equal if it meets quality and performance.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate, recycle and dispose of waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Collect and separate for disposal: paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with waste management plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

.5 Fold-up metal bending, flatten and place in designated area for recycling.

1.11 GUARANTEE

.1 Provide, in supplement of other system guarantee, in writing, a guarantee covering all labor and material for a period of one year from final acceptance of work, and agree to repair and make good all defects during that time.

.2 When the project is completed a documentation file is to be given to the Department of Transportation and Infrastructure – Buildings Division. The file should contain all warranty information.

.2 Prior to expiration of the construction contract warranty, the owner will carry out functional performance testing (FPT). The Contractor will cooperate fully with the Department of Transportation and Infrastructure – Buildings Division request for warranty service and pay for all associated costs.

.3 From the date of issuance of a 'Certificate of Substantial Performance', all equipment, materials and workmanship must be unconditionally warranted for a period of one (1) years, or such longer periods as may be provided in the warranty of the manufacturer of individual components, whichever is longer.

.4 Defects and deficiencies which originate or become evident during the warranty period must be repaired or replaced, at no additional cost. All work relating to said deficiencies must be carried out at a time, during or after normal working hours, which is acceptable to the occupant.

1.12 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1, latest revision, except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 and No.7, latest revisions except where specified otherwise.

.3 Abbreviations for electrical terms: to CSA Z85-1983, latest revision.

.4 Electrical system to conform to latest revision of Model National Energy Code of Canada for Buildings

1.13 CARE, OPERATION AND START-UP

.1 Instruct Consultant and operating personnel in the operation, care and maintenance of system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service representative to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 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 all aspects of its care and operation.

1.14 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83, latest revision.

.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.

1.15 ADDENDA AND REVISIONS

.1 All addenda, instructions and revisions issued during the tendering period shall become part of the Contract Documents and shall be included in the Tender, and shall take precedence over previous instructions.

.2 The Consultant reserves the right to make revisions to the drawings during the period of construction and these revisions shall take precedence over previously issued drawings. All revisions to work shall be executed by duly authorized change orders, with the amount of addition or deduction to the contract amount approved by the Owner before the execution of any work entailed in the revisions.

1.16 EXAMINATION OF DRAWINGS AND EXISTING CONDITIONS

.1 The Electrical Contractor shall become completely familiar with drawings and specifications, as well as construction methods of other trades related to the work, in order to avoid possible conflicts on the project. Should drastic changes be necessary to resolve such conflicts, the Contractor shall notify the Consultant and secure written approval and agreement on necessary adjustments before the installation is started.

.2 Prior to close of tender, the Contractor shall visit the site and become familiar with site conditions, availability of storage space and all other factors that might influence the tender. No allowance shall be made for problems arising due to lack of knowledge of existing conditions that could reasonably have been ascertained by a careful inspection.

1.17 DISCREPANCIES

.1 If, during the preparing their tender, Bidders find any errors, omissions, or discrepancies in the plans, specifications or other documents or having any doubt regarding the intent or meaning of any part thereof, shall immediately notify the Consultant, who will send written instructions or clarification to all bidders. Where such discrepancies exist and it is evident that the Contractor could not have properly tendered without clarification, and where such clarification was not requested, no changes to the contract shall be considered in order to have the installation completed correctly. The Owner and Consultant shall not be responsible for oral instructions.

1.18 SUBSTITUTIONS

.1 It is the intent of these specifications to establish the required quality of materials. Where manufacturer's name and catalogue reference data are used, it is done in order to establish the required quality, style, size or function. The decision as to suitability shall rest with the Consultant.

.2 Refer to Section 01 61 00 – Common Product Requirements.

.3 All materials not meeting the standards as set down by these specifications shall not be allowed on the job site.

.4 Substitutions affecting the design will not be permitted. Additional costs to any other trade or to Consultant as a result of a change or substitution by this Contractor shall be borne by this Contractor.

.5 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer or only products of that manufacturer. Only products meeting the standards as set out in the specifications will be accepted.

.6 All requests for alternates shall be submitted before award of contract.

.7 Faxes are <u>not</u> acceptable for request for alternates. If sent by fax, they will not be reviewed.

1.19 OPERATION AND MAINTENANCE MANUALS

.1 The Electrical Contractor shall provide three (3) copies of Operation and Maintenance Manuals in accordance with Section 01 78 00- Closeout Submittals. The manuals shall consist of a hard cover three ring binder with removable pages, indexed and tabbed as to content. A copy of all electronic files shall be included on a USB stick.

.2 Include in Operation and Maintenance Manuals:

- .1 Copy of all approved shop drawings.
- .2 Details of design elements, construction features, component function and maintenance requirements to permit the effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
- .3 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature unacceptable.
- .4 Wiring and schematic diagrams and performance curves.
- .5 Name and addresses of electrical contractor.
- .6 Names and addresses of local suppliers.
- .7 Copy of all test certificates including but not limited to:
  - .1 Insulation / Megger tests,
  - .2 Load balance tests on all transformers, the main switchboard and distribution panels.
  - .3 Voltage regulation / tap tests on all transformers.

.4 Load tests on all electric motors.

.5 Work report c/w dates from Electrical Inspection Department including electrical permit associated with the project.

.6 Security system testing and verification with approval from Authority having Jurisdiction.

.8 Copy of all final panelboard schedules including existing where modified by this contract.

.9 Copy of signed transmittal verifying all maintenance materials turned over to the owner/user.

.10 Copy of divisions 26, 27 and 28 specifications.

.11 Copy of electrical permit associated with the project.

.12 A letter of warranty.

.13 Other documents as specified within various sections of these specifications.

1.20 RECORD DRAWINGS

.1 Provide “Record Drawings” in accordance with Section 01 78 00 - Closeout Submittals.

.2 After award of Contract, Consultant will provide 2 sets of white print drawings for purpose of maintaining record drawings. Using Red Ink, accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Consultant. Electronic (CAD) files shall be acceptable for record drawings. When using electronic files, Contractor shall have all modifications clearly shown on a separate layer and using a red color font.

.3 Record locations of concealed components of electrical services.

.4 As-built drawings to include the final layout and location of all electrical equipment devices, outlets and pull boxes installed.

.5 As-built drawings to include routing of all electrical services such as feeders, and branch wiring for all electrical systems as noted in Division 26, 27 and 28 contract documents.

.6 As-built drawings from the contractor shall be signed by the contractor.

.7 A complete and separate set of white prints is to be kept on the site at all times.

.8 These prints to be marked up to record clearly, neatly, accurately and promptly, all locations of Electrical work, deviations from and changes to the "Issued for Construction" Documents.

.9 The accurate locations, depth, size and type of each underground utility and service line to be recorded before concealment, to ensure accurate and future direct access to these buried services. Dimensioning on ‘record’ drawings shall refer to the building or other permanent fixtures for future reference.

.10 The Record Drawings will be reviewed at regular intervals by the Engineer-Architect and will be taken into consideration when reviewing the monthly applications for progress payment.

.11 Identify drawings as “Project Record Copy”. Maintain in new condition and make available to Consultant for inspection on-site and at all job meetings.

.12 On completion of Work and prior to final inspection, submit record documents to Consultant for preparation of “Record Drawings” transparencies.

1.21 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 – Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Control panels and component assemblies shall be factory assembled.

.4 Where electrical equipment rooms are sprinklered in accordance with the National Building Code of Canada, the electrical equipment contained in such rooms is to have enclosures which comply with Canadia Electrical Code Rule 26-008.

.5 All equipment must fit into the space and configuration allocated. The Contractor to be responsible for resolving any increase in space requirements or configuration difficulties, due to non-conformity of said condition.

.6 The Contractor to ensure that all carried products, are completely physically and electrically compatible.

1.22 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings.

.3 Review Mechanical drawings; coordinate final electrical connection to all mechanical equipment and controls with mechanical drawings.

.4 Coordinate location of equipment in elevator machine room & pit with supplier.

1.23 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1, latest revision.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1, latest revision.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.24 LOCATION OF DEVICES AND EQUIPMENT

.1 Locate outlets as shown on drawings and as indicated below.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of devices, zone boxes, terminal panels, equipment and connections at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical, boiler and elevator machine rooms on latch side of door.

.5 Leave space clear and install equipment to accommodate future materials and/or equipment as indicated or specified, or to accommodate equipment and/or materials supplied by other trades.

.6 Verify that the spaces in which the equipment is to be installed is sufficient and install all equipment to maintain head room and clearances, to conserve space, comply with codes, and to ensure adequate space for future servicing.

.7 Locate outlets at casework and in typical rooms as per architectural casework details and wall elevations

.8 Install polyethylene vapor barrier box on all exterior wall outlets to maintain vapor barrier integrity.

1.25 ACCESS DOORS

.1 Access doors for furred ceilings or spaces for servicing equipment and accessories or for inspection of safety, operating or fire devices for installation under section erecting the walls or ceilings. Provide general contractor with number, type, size and locations prior to tender close.

.2 Access doors shall be flush mounted (600 x 600) mm for body entry and (300 x 300) mm for hand entry unless otherwise noted. Doors shall open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps. Steel shall be prime coated. Doors shall be of approved manufacturer with published literature. Door flanges to have prepunched holes so that drywall compound will conceal flange and only steel door is visible.

.3 Access doors to be supplied and installed by General Contractor.

1.26 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches and sensors: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 455 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters: 150 mm
  - .4 Above top of counter splash backs: 150 mm.
  - .5 In mechanical rooms: 1400 mm.
  - .6 In utility rooms: 1400 mm.
  - .7 In washrooms and janitor closets: 1400 mm.
  - .8 Exterior: 600mm above level 1 slab.
- .3 Panelboards: 1500mm or as required by Code or as indicated.
- .4 Thermostats: 1500 mm.
- .5 Telephone and interphone outlets: 450 mm.
- .6 Intrusion alarm detectors: 2400 mm
- .7 Door operator pushbuttons: refer to architectural
- .8 Exit lights: 150 mm above door frame (or equivalent where no door is present).
- .9 Emergency lights: 3000 mm or at ceiling where ceiling is lower. Coordinate device heights with architectural room and casework elevations.

.4 Coordinate device heights with architectural room and casework elevations.

.5 Generally, masonry outlet boxes are to be installed in bottom of concrete boxes to approximate heights indicated.

.6 Refer to all detail drawings and confirm mounting of devices prior to roughing-in.

.7 In renovated areas, mounting height shall be match those of existing devices.

1.27 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 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduit and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 All core drilling patching and firestopping of penetrations through walls and floors shall be the responsibility of the General Contractor.

.5 Core drill through walls and floor, as required. Submit exact locations and sizes to Consultant for approval prior to drilling.

.6 Any required trenching of floors, or removal of existing T-bar ceilings for the running of conduit or cables shall be the responsibility of the General Contractor, unless stated otherwise on drawings.

.7 Install cables in cable tray per CSA C22.1, latest revisions.

.8 Seal all conduits which enter air handling units, cooler or freezers in accordance with CEC rule 22-302.

1.28 VOLTAGE DROP

.1 All conductors shall be sized for a maximum voltage drop of 3% cable run and a total of 5% from Utility supply service to device. Contractor shall use connected load for directly connected equipment otherwise the voltage drop shall be calculated based on 80% of the rating of the overload or overcurrent device protecting the circuit or feeder. Loads indicated in the panel schedule are only used to calculate the demand load and shall not be used for determining the voltage drop.

.2 Following table identifies the maximum wire run allowed based on wire gauge. Contractor shall apply this table and used the identified wire gauge. For other types of receptacles, voltage drop shall be calculated using 80% of the overcurrent protection device.

Minimum wire gauge for 5-15R receptacles			
Distance (meters)			*Conductor Phase/Neutral/Bond (AWG)*
0m	to	19m	#12/#12/#12
20m	to	34m	#10/#10/#10
35m	to	54m	#8/#8/#8
55m	to	85m	#6/#6/#6
Minimum wire gauge for 5-20R receptacles			
Distance (meters)			*Conductor Phase/Neutral/Bond (AWG)*
0m	to	14m	#12/#12/#12
15m	to	24m	#10/#10/#10
25m	to	39m	#8/#8/#8

40m	to	64m	#6/#6/#6
65m	to	99m	#4/#4/#4

.3 Receptacles requiring wire gauge greater than #10 AWG shall have a junction box install in the nearest readily accessible ceiling reducing cable gauge to #10 for connection to receptacle terminals.

1.29 LOAD BALANCE

.1 Measure phase current 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 in maintenance manual.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 At completion of work, include in the maintenance manual, a report listing phase and neutral currents on: panelboards, dry-core transformers and motor control centers, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.30 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 Conduct and pay for following tests:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and associated controls.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Fire pump and all motor load tests.

.6 Uninterruptable Power Supply (UPS) tests.

.3 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.4 Insulation resistance testing for main feeder installations.

.1 Test for cable insulation resistance shall be made by qualified field technician; name and certification shall be submitted for approval to Consultant if requested.

.2 Perform Megger tests on all wire insulations as per manufacturer instructions prior to energizing.

.3 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument and Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument. For other equipment, consult manufacturer for proper equipment.

.4 Take readings using the Time Resistance Method (successive reading for a period of 10 minutes). A good insulated device will show a continual increase in resistance.

.5 Wear appropriate personal protective equipment (PPE).

.6 All tests shall be recorded on a form sheet signed by the person performing the test and dated. A copy shall be submitted to the Consultant and another copy placed in the Operation and Maintenance Manual.

.7 Check resistance to ground before energizing.

.8 Inform Consultant of proposed corrective action if cable fails visual and/or insulation testing.

.5 Carry out tests in presence of Consultant.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Consultant's review.

1.31 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

1.32 AUTHENTIC MANUFACTURER

.1 Only authentic manufacturer equipment purchased through an authorized distributor shall be accepted. Refurbished or used equipment are not acceptable and if found will be replaced by authentic parts at contractor expense.

1.33 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Consultant with schedule within 2 weeks after award of Contract.

1.34 SCHEDULE

.1 Note that the Owner intends to carry on business as usual and work activities must be coordinated to maintain electrical services in occupied areas. Provide any required temporary work.

.2 Work activities which disrupt occupants of the building, such as excessive noise caused by drilling of walls, floors or ceilings must be approved and scheduled in writing with the building maintenance superintendent at least 48 hours in advance, and done outside normal working hours.

.3 All power shutdowns which affect building occupants or building operation must have prior approval of Owner and must be scheduled in writing at least 7 days in advance with the building maintenance superintendent.

.4 Overtime work and work outside normal work hours deemed necessary to accomplish scheduling are the responsibility of the Contractor and must meet the requirements of the Department of Post-Secondary Education, Training and Labour. All costs resulting from such Overtime work must be included in the Contractor's total tender price.

.5 Engineer-Architect may require work to be done in phases. Refer to Division 01 – General Requirements for additional information and requirements. All costs associated with phasing must be included in the Contractor's total tender price.

.6 If required by Engineer or Architect, contractor shall supply man hours related to each task identified in the construction schedule. [*only for large project requesting a detailed construction schedule*]

1.35 PROJECT COORDINATION

.1 The Electrical Contractor shall totally review all architectural, structural and mechanical drawings and specifications to coordinate and determine work associated with electrical work prior to submitting tender price. Also, review all Addendums associated with all trades.

.2 After review of all documents associated with other trades, forward any questions and obtain answers by Addendum, prior to tender submission.

.3 Submission of tender by Electrical Contractor acknowledges coordination with other trades as part of these contract documents.

.4 Whenever differences occur between plans and diagrams or schematics, and between specifications and diagrams, the maximum condition shall govern and the tender shall be based on whichever is the greater amount.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 The use of any product not listed by name in the specification must be approved prior to tender submission. Refer to Section 00 21 14 – Instructions to Bidders.

.2 By using pre-approved product substitutions, the Contractor accepts the responsibility and associated costs for all required modifications to circuitry, devices and wiring. The Contractor shall submit complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate colour to the Engineer-Architect for review and approval prior to rough-in.

.3 To meet design constraints there will be no alternates accepted for inverters or battery storage components.

2.2 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.4 Language operating requirements: provide identification nameplates and labels for control items in English.

2.3 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Division 01 – General Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 – ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

.4 Where electrical equipment rooms are sprinklered in accordance with the National Building Code of Canada, the electrical equipment contained in such rooms is to have enclosures which comply with Canadian Electrical Code Rule 26-008.

.5 All equipment must fit into the space and configuration allocated. The Contractor to be responsible for resolving any increase in space requirements or configuration difficulties, due to non-conformity of said condition.

.6 The Contractor to ensure that all carried products, are completely physically and electrically compatible.

2.4 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and coordination responsibilities related to motors, equipment and controls, as indicated. Verify size, location and wiring requirements of all equipment with appropriate trade, reviewed shop drawings and site conditions prior to rough-in.

.2 Provide control wiring and conduit, except for conduit, wiring and connections below 50V which are related to control systems specified in mechanical sections and shown only on mechanical drawings.

.3 security areas and key latches provided where tampering is a concern. Steel to be prime coated. Access doors to be from an approved manufacturer with published literature.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

Part 3 Execution

3.1 WORKMANSHIP

.1 All connections and terminations shall be securely tightened so that heat cycling over the life of the equipment does not result in loose or overheated connections. Lugs, terminals, and wire shall be compatible materials not subject to electrolytic corrosion.

.2 All panels, equipment, conduit, and wiring shall be installed to avoid interferences with other equipment or working spaces. Layout all work in consultation with other trades and suppliers. Adhere to manufacturers shop drawings to locate conduits and terminations. Keep equipment and wiring clear of high temperature areas, where possible.

.3 When handling equipment, ensure that only proper lifting lugs or jacking pads are used, and that slings are clear of equipment.

.4 All equipment shall be properly leveled, plumbed, shimmed, secured in place, and grouted where necessary. Equipment shipped in pieces shall be securely assembled using all bolt holes provided.

.5 Where applicable, equipment shall be mounted so as to permit access by operations or maintenance personnel.

.6 Contractor shall provide watertight weather protection to seal all openings to the exterior required by this contract.

.7 Contractor shall provide watertight weather protection to seal all openings of sprinkler and rainthight equipment required by this contract.

3.2 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 26 00 10 - Electrical Installations General Requirements.

1.2 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core for non-essential power equipment, red face, white core for equipment on essential power, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate and label.

.6 Identification to be English.

.7 Use one nameplate or label for both languages.

.8 All panels, disconnect switches, transformers, control panels, starters and other electrical equipment enclosures shall be provided with lamicoid nameplates. Nameplates shall be mechanically attached to all metal surfaces with metal type “pop-rivets” where possible.

.9 Nameplates that are attached to building exterior surfaces shall use nylon inserts and self tapping screws unless noted otherwise.

.10 Nameplates to other surfaces shall be affixed with contact type cement. Contact type cement shall be applied to complete back side of plate, as opposed to several points or locations on same.

.11 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics branch circuit breaker number. Label both box and cover.

.12 Nameplates for control panels, disconnects, starters and contactors: indicate equipment being controlled and voltage, phase, no. of wires, designated power source, branch circuit breaker numbers and HP or KW rating where applicable.

Example

Motor M-1 – 10HP 600V – 3PH – 3W Fed from MCC-1-2B

.13 Pull boxes: indicate system and voltage.

.14 Terminal cabinets and pull boxes: indicate system and voltage.

.15 Transformers: indicate capacity, primary and secondary voltages.

.16 Distribution panelboards, MCC's and splitters:

.1 Designated name of equipment,

.2 Overcurrent protection device rating,

.3 Voltage, phase, no. of wires and bus capacity,

.4 Designation of power source.

Example

MCC-1 – 600A 347/600V – 3PH – 4W Fed from Panel DPA-X4

.17 Panelboards: indicate voltage, current and panel number. Install additional lamicoid nameplate to indicate breakers which have been designed for, and incorporate an interrupting capacity sized larger than 10 KAIC.

.18 All wiring devices, including but not limited to receptacles and switches, shall have a transparent circuit identification permanently installed on coverplate indicating panelboard and circuit. Acceptable labelling product: Panduit #LS5 c/w LS5-530 tape or equivalent.

.19 All wiring devices, including but not limited to receptacles and switches, shall be labeled to identify panelboard and circuit with lamicoid nameplate mechanically fixed to wall above coverplates. Lamicoid shall be white face with black lettering for non essential power and red face with white lettering for essential power.

Example

EFG-36

.20 Cabinets: label as indicated.

.21 An additional lamicoid nameplate shall be installed on any piece of electrical equipment that has been designed to contain overcurrent protection devices having an interrupting capacity larger than 10 KAIC. Confirm such equipment with electrical drawings.

Example

Minimum interrupting capacity of breakers installed in this panel shall be no less than 22KAIC

1.3 WIRING IDENTIFICATION

.1 Identify wiring (including neutral conductors) with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring including in all junction boxes/ pull boxes located between.

.2 Markings shall indicate panel and circuit number; i.e., A1-27. Normal ground circuits to have ground, neutral and phase wires identified with black on white background tape or insulation.

.3 Tape to be vinyl, self-adhesive Electrovert Type Z Markers or equivalent.

.4 Use coloured plastic tapes to identify feeders on both ends of phase conductors and at junction and pull boxes of conductor insulation colours are other than red, black, blue, white and green.

.5 Maintain phase sequence and colour coding throughout.

.6 Colour code: to CSA C22.1.

.7 Use colour coded wires in communication cables, matched throughout system.

.8 Use colour coded wires in communication cables, matched throughout system. When category 6 communication cables are used, the following colour standard shall be followed:

Wireless Access Point	**Yellow**
HVAC	**Green**
Cameras	**Purple**
Uplink	**Red**
Specialty	**Black**
Standard Data	**White**
Telephone	**Blue**

1.4 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
50V to 249V Normal	Green	
50V to 249V Emergency	Orange	
250V to 749V Normal	Blue	
250V to 749V Emergency	Yellow	
Low Voltage (ex. Lighting controls)	White	Pink
Telephone (Wired and Wireless)	White	
Data (includes Fiber, Multimedia)	White	Yellow
Public Address	White	Green
Nurse Call	White	Red
Intercom	White	Blue
Clock	White	Orange
Dictation	White	Brown
Intrusion	Red	Blue
CCTV	Red	Green
Door Access	Red	Orange
Fire Alarm	Red	
Fire Alarm Voice	Red	Black
Medical Gas Alarms	Red	Yellow
Patient Monitoring	Orange	Black
Controls (ex. HVAC)	Brown	Orange

.4 Contractor shall coordinate colors with existing building color coding, if any, and modify accordingly. All modifications shall be registered in Operation and Maintenance Manuals.

.5 All electrical and communication conduits shall be color coded as per Health Centre requirements.

1.5 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.6 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.7 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Consultant.

.2 Porcelain enamel signs, minimum size 175 x 250 mm.

.3 All warning signs shall be in accordance with Occupational Safety and Health Administration (OSHA) regulations and shall be suitable for exterior use. The warning sighs shall be fastened with round head, type 316 stainless steel screws or bolts, located and mounted in a manner acceptable to the Engineer and be bilingual.

.4 Mount on back and front, approximately 1,500mm above grade, clearly lettered “HIGH VOLTAGE” sign for warning personnel.

.5 High voltage warning signs shall be as follow:

.1 Colored red with white lettering.

.2 178mm high by 254mm wide on a 1.6mm thick plastic or similar acceptable material.

.3 Text shall read:

1.8 SINGLE LINE ELECTRICAL DIAGRAMS

.1 Supply single line electrical diagrams under Plexiglas as follows:

.1 Electrical distribution system: locate in main electrical room.

.2 Drawings: 600 x 600 mm minimum size.

PART 2 Products

2.1 NOT USED

PART 3 Execusion

3.1 FIELD QUALITY CONTROL

.1 Contractor shall submit wording for all labels, nameplates and lamicoids to Consultant for review and approval. Failure to comply shall result in the replacement of all nameplates, labels and lamicoids at the contractor cost.

.2 Contractor shall submit all single line diagrams to Consultant for review and approval. Failure to comply shall result in the replacement of all single lines.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA InternationalCAN/CSA-C22.2 No.18, latest revision, Outlet Boxes, Conduit Boxes and Fittings.

.1 CAN/CSA-C22.2 No.65, latest revision, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, latest revision, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Crimp style wire connectors, nylon insulated, with current carrying parts of copper alloy, for conductors #16 AWG and smaller.

.4 Fork tongue, nylon insulated, crimp style terminals for connecting conductors #16 AWG and smaller to screw down terminals.

.5 Crimp style wire connectors, nylon insulated with current carrying parts of copper alloy, for connecting solid to stranded conductors.

.6 Compression type connectors or terminal blocks in suitable enclosure for connecting #6 AWG conductors and larger, unless indicated otherwise. Compression type connectors to have a temperature rating of 90 deg. C.

.7 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for round copper conductors.
- .2 Clamp for stranded copper conductors.
- .3 Clamp for stranded aluminum conductors .
- .4 Stud clamp bolts.
- .5 Bolts for copper bar.
- .6 Bolts for aluminum bar.
- .7 Sized for conductors, bars as indicated.

.8 Clamps or connectors for armoured cable, TECK cable aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

.9 Connection to motors shall be done using a dielectric insulation silicone gel as per Raychem GelCap motor connection kit or equivalent.

.10 Waterproof gel filled twist-on type wire connectors to: CAN/CSA-C22.2 No.65 and UL486D, with current carrying parts of copper alloy sized to fit copper conductors as required.

.1 Suitable for use in damp, wet, raintight and submersible locations.

.2 Temperature rating: 105 deg. C.

.3 Silicone sealant temperature: -43 deg. C to 204 deg. C.

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 wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.

.3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

.2 Use gel filled connectors for splices in damp or wet locations such as in exterior light fixtures and receptacles.

.3 No splices are allowed in panelboards (distribution, lighting and power) or in equipment enclosures.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 – Wire Box and Connectors (0 – 1000V).

.2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.3 Section 26 05 36 –Cable Trays for Electrical Systems.

.4 Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.

1.2 REFERENCES

.1 Canadian Standard Association (CSA)

.1 CSA C22.2 No. 0.3, latest revision, Test Method for Electrical Wires and Cables.

1.3 PRODUCT DATA

.1 Provide product data in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors:

.1 Solid for 10 AWG and smaller, stranded for 8 AWG and larger.

.2 Minimum size: 12 AWG for branch circuits, 12 AWG for bonding, 14 AWG for control circuits.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted.

.3 Aluminum Conductor Material (ACM): sized in accordance with Canadian Electrical Code, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, non-jacketted. Minimum size permissible: #1/0 AWG.

.4 Conductor sizes on drawings are based on copper conductors. If ACM conductors are used, size must be adjusted to have equivalent ampacity.

.5 Note that copper conductors must be used where connected to 100% rated molded circuit breakers.

.6 Equivalent sized aluminum conductors shall be permitted for feeders fed from overcurrent devices rated 100A and above. Refer to electrical single line diagram cable list on drawings. Contractor shall provide credit if aluminium conductors are used. Even more, if aluminum conductors are used, the contractor is responsible to size the wires and conduits according to the CEC and shall ensure that the equipment can physical accept the bigger conduit/wires. No extra will be permitted for changes required for using aluminium conductors. Note that copper conductors must be used where connected to 100% rated molded circuit breakers.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Cable: to CAN/CSA C22.2 No. 131-M89 (R1994), Type TECK 90 Cable.

.3 Conductors:

- .1 Grounding conductor: copper unless indicated otherwise.
- .2 Circuit conductors: copper unless indicated otherwise on drawings, size as indicated.

.4 Insulation:

- .1 Ethylene propylene rubber EP.
- .2 Cross-linked polyethylene XLPE.
- .3 Rating: 600V.

.5 Inner jacket: polyvinyl chloride material.

.6 Armour: interlocking aluminum.

.7 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project FT6.

.8 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 1500 mm centers.
- .3 Threaded rods: 6 mm minimum diameter to support suspended channels.

.9 Connectors:

- .1 Watertight, approved for TECK cable.
- .2 Explosion proof approved for TECK cable where indicated.

.10 Termination kits: [field installed] [factory installed] approved for MI cable

2.3 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD90XLPE size as indicated.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

.1 All work to be concealed in finished areas.

.2 Service: building wire in conduit, copper or ACM conductors.

.3 Panel Feeders:

- .1 Feeders fed from an overcurrent device rated up to and including 100A to utilize copper conductors in conduit.
- .2 Feeders fed from an overcurrent device rated above 100A may utilize copper or ACM conductors in conduit.

.4 Branch circuit work:

- .1 Concealed work in wall partitions: NMD 90.
- .2 Horizontal work above accessible ceilings: NMD 90.
- .3 Surface work: building wire in conduit.

.5 Mechanical equipment: NMD 90 or Teck cable, maximum length 1500 mm.

.6 Drops to light fixtures, rotating and vibrating equipment: building wire in flexible conduit or armoured cable, maximum length 1500 mm.

.7 Install cable in trenches in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.

.8 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.9 Cable Colour Coding: to Section 26 00 53 – Identifications for Electrical Systems.

.10 Conductor length for parallel feeders to be identical.

.11 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.12 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.13 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

.14 When pulling cable, precaution must be taken to avoid exceeding cable maximum pull tension and minimum bending radius.

.15 Wiring for outdoor to use building wire in conduit with liquid tight for drops to lights and equipments.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 In underground ducts in accordance with Section 26 05 43.01 – Installation of Cables on Trenches and in Ducts.

3.3 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by straps.

.3 Fasten in place at 1500 mm intervals and 300 mm from terminations.

.4 Use VFD cable between drive and motor where distance exceeds 10 m.

3.4 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

3.5 RESTRICTIONS

.1 Splices in wire and cable #6 AWG and larger are not permitted.

.2 Wiring and cabling installed directly in ceiling cavities must be run parallel and perpendicular to building lines. Wherever possible, wiring and cabling is to follow a common pathway.

.3 Flexible conduit or armoured cable drops to light fixtures to be installed from junction box to fixture. Loops between fixtures are not acceptable.

.4 Maximum exposed length of armoured cable from junction box to wall partition to be 3000 mm.

.5 All wiring for services within the building must be installed on the warm side of the vapour barrier unless prior approval is obtained from the Engineer-Architect to run on the cold side.

.6 Refer to Section 26 05 29 – Hangers and Supports for Electrical Systems, for acceptable support methods.

.7 Do not install cables, raceways and boxes directly to underside of roof decking. Support cables, raceways and boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

.8 RW90 wire in EMT conduit must be used where exposed.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837, latest revision, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International

.1 CSA C22.2 No.41, latest revision, Grounding and Bonding Equipment (Bi-National Standard with UL 467).

.2 CSA Z32, latest revision, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

.3 NB Power.

.1 Standard Construction Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.

.3 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.

.4 Plate electrodes: copper, surface area 0.2 m^2, minimum 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.6 Insulated grounding conductors: green, copper conductors, size as indicated.

.7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

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 grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION GENERAL

.1 Electric power utility equipment including bollards if applicable, must be grounded in accordance with utility Standard Construction Practices.

.2 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run green insulated bonding conductor in all conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837 as indicated.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.10 Install separate ground conductor to outdoor lighting standards.

.11 Connect building structural steel and metal siding to ground by welding copper to steel.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.13 Ground secondary service pedestals.

3.3 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod electrodes and make grounding connections as indicated.

.5 Bond separate, multiple electrodes together.

.6 Use size 2/0 AWG copper conductors for connections between electrodes.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.

.2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, data, sound, fire alarm, security systems, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Data: make data grounding system in accordance with ANSI J-STD-607-A and data installer’s requirements.

.3 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.7 PERMAFROST

.1 Bond non-current carrying metal parts together with size #6 AWG copper equipotential conductor. Run conductor from separate lug or service neutral bar to, but not necessarily limited to, following indoor systems and equipment:

.1 Hot water heating system.

.2 Main water pipe.

.3 Main building drain.

.4 Telephone, radio/tv, emergency and fire alarm lead-in or service conduits, near panels.

.5 Make connections to pipes on building side of main valves and tanks. Connect jumpers across boilers to supply and return hot water heating pipes.

.2 Drive three -19 mm diameter x 3 m copper clad ground rods at least 1.8 m apart in original undisturbed ground. If rods will not penetrate permafrost, drive at angle not more than 60 degrees from vertical, and in same direction. Rods must be driven, not trenched.

.3 Install ground wire from service neutral bar to rods and where buried use bare copper not smaller than size 1 AWG strand or size 4 AWG solid, and at least 640 mm below ground. Bond ground conductor, or short tap from it, to outside metal sheathing of building close to power service conduit. Use lug or cast clamp, with bronze or plated bolt, nut and washers (not sheet metal screw or wood screw). Remove paint from sheathing for good contact. Conduit is required only on outside wall of building. Indoors, run bare and fasten as specified for equipotential bonding wire.

.4 Install electrode interconnections where metal parts, circuits or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 00 10 – Electrical Installations General Requirements.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, pre-galvanized steel, [stainless steel 304] surface mounted or suspended as required.

2.2 SPECIFIC PURPOSE SUPPORTS

.1 Specific purpose heat treated, spring steel fasteners to support boxes, conduit and cable from main structure, channels, metal studs and T-bar ceilings.

.2 Acceptable manufacturer or approved equal:

.1 B-Line.

.2 Thomas & Betts.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment to inverted T bar ceilings with bar type box hangers fastened to grid. Ensure that T-bars and box hangers are adequately supported to carry weight of equipment specified before installation. Box hangers to be connected to building structure with independent hanger wire.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers (trapeze system) where direct fastening to building construction is impractical. Threaded rods to be attached the ceiling structure.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing, perforated strap, nylon or plastic self locking cable ties (Ty-raps) to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

.13 Do not use T-bar ceiling hanger wires to support conduit and cable.

.14 Do not install cables, raceways and boxes directly to underside of roof decking. Support cables, raceways and boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

.15 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, latest revision, Canadian Electrical Code, Part 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat covers.

Part 3 Execution

3.1 JUNCTION AND PULL BOXES

.1 Install junction boxes and pull boxes in inconspicuous but readily accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Size and install junction and pull boxes to CSA C22.1.

.5 Do not install junction and pull boxes directly to underside of roof decking. Support junction and pull boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

3.2 IDENTIFICATION

.1 Equipment Identification: to Section 26 00 53 – Identification for Electrical Systems.

.2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, latest revision, Canadian Electrical Code, Part 1.

.2 CSA C22.2 No. 45, latest revision, Rigid Metal Conduit.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Submit samples for floor box covers in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 The wiring from the essential power system shall be kept separate from other wiring.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required. keep smaller jobs

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

.6 Round type plaster rings to be used in plaster construction only.

.7 Extension rings for flush mounting devices in manufactured casework as required.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS - GENERAL

.1 Set-screw type steel couplings and connectors for EMT. Connectors to have nylon insulated throats for conduits 27 mm and larger.

.2 Steel connectors, nylon insulated for flexible conduit.

.3 Bushing and connectors with nylon insulated throats.

.4 Knock-out fillers to prevent entry of debris.

.5 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.

.6 All fittings entering sprinkler proof or rain tight equipment shall be of watertight protection type.

.7 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Outlet boxes installed in steel stud partition walls to be supported with steel screw gun box brackets installed between studs.

.4 The use of surface mounted conduit boxes is to be minimized, limited to unfinished areas and is subject to the prior approval of the Consutlant.

.5 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.6 Refer to architectural details for boxes to be mounted in or behind casework and ensure box comes within 6 mm of opening. Install box extensions as required.

.7 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.8 Vacuum clean interior of outlet boxes before installation of wiring devices.

.9 Identify systems for outlet boxes as required in accordance with Section 26 00 53 – Identification for Electrical System.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18, latest revision, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45, latest revision, Rigid Metal Conduit.

.3 CSA C22.2 No. 56, latest revision, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83, latest revision, Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2, latest revision, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3, latest revision, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.4 LOCATION OF CONDUITS

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

1.5 CONDUIT SIZE

.1 Conduit sizing, where indicated, is based on copper conductors and rigid steel conduit. Where aluminum conductor material (ACM) is used or where conduit type requires an additional bond wire, adjust conduit size to suit.

Part 2 Products

2.1 CABLES AND REELS

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with steel set-screw coupling and connectors.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, steel.

.6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Steel Set-screws connectors for EMT.

.4 Watertight connectors with O-ring gasket for all sprinkler environment installation.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

2.7 SEALANT

.1 Low VOC mastic compound.

.1 Acceptable manufacturer or approved equal:

.1 Flex Grip.

.2 Kingco 11-600.

.3 Uni-mastic 181.

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

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Install conduit parallel or perpendicular to building lines.

.4 Use epoxy coated conduit in corrosive areas.

.5 Use electrical metallic tubing (EMT) except in cast concrete, above 2.4 m not subject to mechanical injury.

.6 Use rigid PVC for branch circuit work in the ice rink.

.7 Use rigid PVC conduit for feeders and branch circuit work under ground floor slab and in poured concrete unless indicated otherwise. Where the use of underground duct is indicated, use duct to rigid PVC conduit transition for conduit extending above finished grade unless indicated otherwise. Apply cleaning and solvent compounds to manufacturer’s recommendations and make joints watertight. Install a separate integral bond wire sized in accordance with CEC in all rigid PVC conduit. Restrictions for use:

.1 Do not use in hazardous locations.

.2 Do not use where exposed.

.3 Must terminate at first flush outlet box in uninsulated wall (maximum allowable length from floor stub out to first outlet box is 1500 mm).

.4 Must be installed minimum of 50 mm below slab.

.5 Must contain an integral bond wire sized in accordance with CEC.

.6 Feeds from building exterior must make transition to EMT upon entering building.

.8 Use flexible metal conduit for connection to motors in dry areas

.9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.10 Use rigid galvanize conduit in explosion proof environments.

.11 Use explosion proof flexible connection for connection to explosion proof motors.

.12 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.13 Minimum conduit size for lighting and power circuits: 21 mm.

.14 Holes for conduit through drywall partitions to be drilled neatly and as small as possible. After installation of conduit through holes, all remaining space surrounding the conduit is to be sealed with acoustical caulking or approved fire stopping material in the case of a rated partition. Penetrations through drywall partitions to be sealed on both sides of the partition.

.1 conduit from junction box to outlet boxes for each computer in sub-floor.

.15 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.16 Mechanically bend steel conduit over 21 mm diameter.

.17 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.18 Install fish cord in empty conduits.

.19 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.20 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.21 Dry conduits out before installing wire.

.22 Conduits shall not be run horizontally in closed wall.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 27 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.8 CONDUIT SEALANT

.1 All conduits entering buildings from underground or penetrating the building vapour barrier must be internally sealed immediately inside the building after installation of wires to prevent the entrance of water and condensation.

.2 Seal conduit using mastic compound.

.3 Install in accordance with manufacturer's recommendations.

3.9 CLEANING

.1 Proceed in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 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 REQUIREMENTS

.1 Section 26 00 10 – Electrical Installation General Requirements.

.2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA-Z809, latest revision, Sustainable Forest Management.

.2 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001, latest revision, FSC Principle and Criteria for Forest Stewardship.

.3 Insulated Cable Engineers Association, Inc. (ICEA)

.4 Sustainable Forestry Initiative (SFI)

.1 SFI – Standard, latest revision.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for cables 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 Section 26 00 10 – Electrical Installation General Requirements and 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 indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect cables from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installation General Requirements.

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm cedar planks.

2.2 MARKERS

.1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on wall mylar label 0.125 mm thick with words Cable or Conduit Entry with depth to indicate building entry point.

.2 Marker tape:

.1 Metal detectable polyethylene marker tape: 75 mm wide for direct burial.

.2 Marker tape to be red in colour with the following words printed in large black block letters: CAUTION CAUTION CAUTION ELECTRIC LINE BURIED BELOW.

2.3 SEALANT

.1 Low VOC mastic compound.

.1 Acceptable manufacturer or approved equal:

.1 Flex Grip.

.2 Kingco 11-600.

.3 Uni-mastic 181.

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 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 DIRECT BURIAL OF CABLES

.1 After sand bed in accordance with Section 26 00 10 – Electrical Installation General Requirements, 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 150 mm minimum for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Make termination and splice only as indicated leaving 0.6 m 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 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain 300 mm 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 0.6 m minimum in each direction at crossings.

.7 After sand protective cover specified in Section 26 00 10 – Electrical Installation General Requirements, is in place, install continuous row of overlapping 38 x 140 mm cedar 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 multiconductor 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.

.8 Install in each empty duct a pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.4 MARKERS

.1 Install wall mounted type markers where underground conduits and/or cables enters a building.

.2 Install marker tape 300 mm below grade and as indicated, continuous over full length of cable ducts.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.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 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000V 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 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 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installation General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installation General Requirements.

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

3.7 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.47-M90, latest revision, Air-Cooled Transformers (Dry Type).

.2 CSA C9-02, latest revision, Dry-Type Transformers.

.3 NRCan 2019 CAN/CSA-C802.2, latest revision, Minimum Efficiency Values for Dry Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dry type transformers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or

Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 DESIGN DESCRIPTION

.1 Transformers to be in accordance with CSA C9 and CAN/CSA C22.2 No.47.

.2 Load and no-load efficiencies and losses to be in accordance with CAN/CSA C802.2.

.3 Use transformers from one manufacturer throughout project.

.4 Transformer design to meet equipment space allowance indicated on drawings.

- .1 Type: ANN.
- .2 3 phase, kVA, V input and V output as shown on drawings, 60 Hz.
- .3 Voltage taps: standard.
- .4 Insulation: Class 1 220 with epoxy impregnation insulation system, 150 degrees C temperature rise.
- .5 Basic Impulse Level (BIL): standard.
- .6 Hipot: standard.
- .7 Average sound level: standard.
- .8 Impedance at 17 degrees C: standard.
- .9 Enclosure: CSA, air ventilated, sprinkler proof, removable metal front panel.
- .10 Mounting: wall as indicated.
- .11 Finish: in accordance with Section 26 00 10 – Electrical Installations General Requirements.
- .12 Copper windings.
- .13 Winding configuration to be as noted on drawings.
- .14 Harmonic Mitigating Phase Shifting transformers as indicated on drawings.
- .15 K-Rated Transformers as indicated on drawings.
- .16 Electrostatic shield.
- .17 Voltage Regulation to be 4% or better.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Label size: 7.

.3 Nameplate wording shall include equipment identification, KVA rating and fed from information.

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 dry type transformers installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated. Mount dry type transformers above 75 kVA on floor on housekeeping pad.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Transformer rated greater then 50kVA shall have a minimum horizontal working space of 1m on the sides that provide access to the conductor connections. Refer to CEC-2-312.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

.9 Make conduit entry into bottom 1/3 of transformer enclosure.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by dry type transformers installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.29, latest revision, Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

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

.3 Shop Drawings:

.1 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 25 kA (symmetrical) interrupting capacity or as indicated.

.3 600 V panelboards: bus and breakers rated for 25 kA (symmetrical) interrupting capacity or as indicated.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Minimum of 2 flush locks for each panel board.

.7 Two keys for each panelboard and key panelboards alike.

.8 Aluminum bus with neutral of same ampere rating of mains.

.9 Mains: suitable for bolt-on breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked enamel.

.12 Isolated ground bus.

.13 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.

.5 Lock-on devices for fire alarm, door supervisory, intercom, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Nameplate for each panelboard size 4 engraved.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

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 panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards (painted with fire rated paint) in accordance with Section 26 00 10 – Electrical Installations General Requirements. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 00 10 – Electrical Installations General Requirements or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Where panels of different systems (i.e. Standard and Vital Power) supply a common patient care area, ground busses in panels to be interconnect with a minimum #6 AWG ground conductor.

.7 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each flush/recessed panelboards.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.8 Breaker locking devices shall be provided as necessary for circuits supplying safety equipment.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42, latest revision, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1, latest revision, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55, latest revision, Special Use Switches.

.4 CSA C22.2 No.111, latest revision, General-Use Snap Switches (Bi-national standard, with UL 20).

.5 CAN/CSA C22.2 No. 144.1-06 (R2011), Ground Fault Circuit Interrupters (Tri-national standard, with UL 943 and NMX-J-520-ANCE)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations and General Requirements.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings as per Section 26 00 10 – Electrical Installations and General Requirements

.1 Indicate on drawings:

.1 Rating

.2 NEMA configuration

.3 Connection method

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations and General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations and General Requirements and 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, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations and General Requirements

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in 26 00 10 – Electrical Installations and General Requirements.

Part 2 Products

2.1 SWITCHES

.1 15A, voltage as indicated, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 white toggle.

.3 Toggle operated locking fully rated for up to 80% of rated capacity of motor loads and/or heating loads with pilot light.

.4 Commercial specification grade must be used.

.5 Switches of one manufacturer throughout project.

.6 Acceptable Manufacturer:

.1 120V Toggle:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.2 120V, Lock Type:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.3 120V, 3 Way Toggle:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.4 120V, 4 Way Toggle

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.5 120V, occupancy sensor type as per Lithonia Sensor Switch # WSX Series or approved equal.

.6 120V, occupancy sensor with dimming type as per Lithonia Sensor Switch # WSX D Series or approved equal.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 White urea molded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.6 Commercial specification grade must be used.

.7 Acceptable manufacturer:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.2 Duplex receptacles CSA type 5-15R, 120VAC, 15A, closed sensitivity of 5mA with following features:

.1 White urea molded housing.

.2 Suitable for No. 10 AWG for side wiring.

.3 Four side wiring screws.

.4 Reset button to rearm GFCI after tripping.

.5 Test button to test trip GFCI for operability.

.6 Commercial specification grade must be used.Acceptable materials:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.3 Duplex receptacles CSA type 5-20RA, 125V, 20A, U ground with the following features:

.1 White area molded housing.

.2 Suitable for No. 10AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Four side wiring screws.

.5 Commercial specification grade must be used.

.6 Acceptable materials:

.1 Hubbell
.2 Leviton
.3 Pass & Seymour

.4 Duplex receptacles CSA type 5-20R, 120VAC, 20A, closed sensitivity of 5mA with following features:
.1 White urea molded housing.
.2 Suitable for No. 10 AWG for side wiring.
.3 Four side wiring screws.
.4 Reset button to rearm GFCI after tripping.
.5 Test button to test trip GFCI for operability.
.6 Commercial specification grade must be used.
.7 Acceptable materials:
.1 Hubbell
.2 Leviton
.3 Pass & Seymour

.5 TVSS receptacle such as Hubell HBL5260SA or approved equal.

.6 USB receptacle such as Hubell SNAP8200UACW or approved equal.

.7 Commercial specification grade must be used.

.8 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 White thick cover plates for wiring devices mounted in flush-mounted outlet box.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

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 wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.
.2 Inform Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 00 10 – Electrical Installations General Requirements unless indicated otherwise.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 All receptacle mounted horizontally shall have the ground contact on the left and all receptacles mounted vertically shall have the ground contact at the top.

.3 Mount receptacles at height in accordance with Section 26 00 10 – Electrical Installations General Requirements unless indicated otherwise.

.4 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.5 Install GFR type receptacles when 20A or 15A receptacle are installed within 1.5 meter of a sink, bathtub or shower stall. Additionally, install GFR type receptacles as indicated on the drawings.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.4 PROTECTION

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

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No. 5, latest revision, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

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

.3 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Consultant for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant. Unless complying with this requirement, Consultant reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title.

.2 End user's reference number.

.3 List of circuit breakers.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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 circuit breakers off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and ground-fault circuit-interrupters, fused circuit breakers, and accessory high-fault protectors: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips on units over 200A or as indicated.

.6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as indicated on single line diagram, minimum of 10kA for 250V and 14kA for 600V.

.7 Circuit breakers to be supplied by the same manufacturer as the panelboard or distribution board in which they are being installed.

.8 Mini circuit breakers, twin or tandem breakers are not acceptable.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.1 .

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 installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install circuit breakers in electrical distribution equipment as indicated.

.2 Use thermal magnetic breakers unless indicated otherwise on drawings.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, latest revision, Enclosed Switches.

.2 CSA C22.2 No.39, latest revision, Fuseholder Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 26 00 10 – Electrical Installation General Requirements.

1.3 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 26 00 10 – Electrical Installation General Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and/or recycling and place in designated containers waste in accordance with Waste Management Plan.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible or non-fusible, Heavy- Duty Nema 12 inside, Nema 3R outside or as indicated, horsepower rated disconnect switch in CSA Enclosure 1, to CAN/CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.

.5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 HP RATED TOGGLE DISCONNECT

.1 Heavy- Duty, horsepower rated toggle disconnect switch in CSA Enclosure NEMA type 12

.2 Provision for padlocking in off switch position.

.3 Acceptable manufacturers:

1. Square D type K
2. Eaton
3. Siemens

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 53 – Identification for Electrical Systems.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1, latest revision, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, latest revision, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41, latest revision, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.

.1 ASTM F1137, latest revision, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.2 ASTM A123/A123M, latest revision, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A167, latest revision, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

.4 ASTM A366/A366M, latest revision, Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.

.4 Illuminating Engineering Society of North America (IESNA)

.1 IES Lighting Handbook, Reference and Application.

.5 Canadian Standards Association (CSA International)

.6 ICES-005, latest revision, Radio Frequency Lighting Devices.

.7 Underwriters' Laboratories of Canada (ULC)

.1 UL 94, latest revision, Test for Flammability of Plastic Materials for Parts in Devices and Appliances.

.2 UL 496, latest revision, Edison-Based Lampholders.

.3 UL 508, latest revision, Industrial Control Equipment.

.4 UL 542, latest revision, Fluorescent Lamp Starters.

.5 UL 595, latest revision, Marine-Type Electric Lighting Fixtures.

.6 UL 1029, latest revision, High-Intensity Discharge Lamp Ballasts.

.7 UL 1570, latest revision, Fluorescent Lighting Fixtures.

.8 UL 1571, latest revision, Incandescent Lighting Fixtures.

.9 UL 1572, latest revision, High Intensity Discharge Lighting Fixtures.

.10 UL 8750, latest revision, The Standard for Safety of Light Emitting Diode (LED) Equipment for use in Lighting Product.

.8 Consortium for Energy Efficiency (CEE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Consultant.

.3 Photometric data to include: VCP Table where applicable.

.3 Quality assurance submittals: provide following in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.3 Packaging Waste Management: remove for reuse and return of pallets, crates, paddling and packaging materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

Part 2 Products

2.1 LIGHT EMITTING DIODE (LED) LUMINAIRE

.1 The LED luminaire shall consist of a LED Luminaire Assembly, LED Driver and mounting hardware.

.2 LED Luminaire requirements shall be as described, but no limited to, below:

.1 Voltage input as indicated in luminaire schedule (±10%), 60Hz.

.2 Correlated Color Temperature (CCT) and Color Rendering Index (CRI) as indicated in luminaire schedule.

.3 Conformance with UL 8750.

.3 LED Luminaire Assembly requirements shall be as described, but not limited to, below:

.1 Definition: Luminaire Assembly is the LED assembly without the LED Driver.

.2 Input voltage shall be 24VDC or 36VDC.

.3 CCT, CRI, minimum life and UL shall be as described in luminaire schedule.

.4 LED Driver requirements shall be as described, but not limited, below:

.1 Voltage operation as indicated on luminaire schedule (±10%).

.2 Operating frequency 60Hz.

.3 Operating temperature between -40°C to +50°C.

.4 Minimum efficiency of 85%.

.5 Self-protected including short circuit protection.

.6 Power factor (PF) ≥ 0.90.

2.2 LIGHT POLES

.1 Supply type, configuration and dimensions as indicated on drawings and in luminaire schedule. Maximum deflection of the poles shall be 5% when fully loaded. Poles shall resist wind loads in accordance with the Canadian Building Code. Supply pole as indicated with handhole and flush cover with tamper proof screw and grounding stud, luminaire mounting tenon/bracket, base cover and mounting hardware including anchor bolts, nuts, washers and baseplate to permit accurate alignment and installation of pole and luminaire as indicated.

.2 Contractor shall be responsible to coordinate with general contractor for pouring of light pole concrete base for exact location and conduit rough-in.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule.

2.6 DRYWALL FRAMING KITS

.1 Except where flanged luminaires are specified, drywall framing kits are to be provided where required to adapt grid trimmed luminaires to drywall ceilings. Frame finish to be

baked white enamel. Refer to architectural drawings and finish schedule to determine where drywall framing kits are required.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

.3 Supply and install all materials and accessories as required for proper mounting of all luminaires.

.4 Install drywall framing kits to adapt grid trimmed luminaires to drywall ceilings as required.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

.2 Install safety cables for all suspended luminaires from the fixture housing to the building structure.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 LIGHT POLES

.1 Install light poles as indicated and in accordance with the manufacturer's recommendations. Light poles shall be grounded as indicated on drawings.

3.6 CLEANING

.1 Clean in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installation General Requirements.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.141, latest revision, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in 26 00 10 – Electrical Installations General Requirements.

1.5 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120V, AC.

.3 Output voltage: 12V DC.

.4 Operating time: 30 minutes.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Auto diagnostics built-in.

.9 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.10 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.11 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 5.7 W, minimum 200 lumen minimum output.

.12 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries. White finish.

.13 Wire guards where indicated.

.14 Acceptable manufacturers for battery pack fixtures as indicated on drawings.

.15 Acceptable manufacturers for remote head fixturesas indicated on drawings.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: Building (RW90) type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized in accordance with manufacturer's recommendations.

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 emergency lighting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Make normal and emergency power connections.

.3 Direct heads.

.4 Connect exit lights to unit equipment.

.5 Test each unit for 30 minutes on emergency.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141, latest revision, Unit Equipment for Emergency Lighting.

.2 CSA C860, latest revision, Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)

.1 NFPA 101, latest revision, Life Safety Code.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.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 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.4 Quality Assurance Submittals: submit following in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 SELF-POWERED UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: extruded aluminum housing, brush aluminum finish.

.3 Face and back plates: cast aluminum alloy.

.4 Lamps: LED-12W, 100,000 hours.

.5 Operation: designed for 100,000 hours LED lamps only, 100,000 hours of continuous operation without relamping.

.6 Pictogram: Dimension as per ISO and color green as per ISO 3854-1.

.7 Downlight: white glass in bottom of unit.

.8 Face plate to remain captive for relamping.

.9 Supply voltage: 120V ac.

.10 Output voltage: 12V dc.

.11 Operating time: 30 minute minimum.

.12 Recharge time: 12 hours

.13 Auto diagnostics built-in.

.14 Battery: sealed, maintenance free.

.15 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.

.16 Solid state transfer circuit.

.17 Signal lights: solid state, for 'AC Power ON' and 'High Charge' condition.

.18 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.

.1 Removable or hinged front panel for easy access to batteries.

.19 Wire guard as required.

.20 Acceptable material:

.1 Lumacell
.2 Aimlite
.3 Ready-Lite

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

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Install pictogram legends as required to direct traffic along path of egress.

.3 Connect exit signs to dedicated circuits as shown on drawings.

.4 Connect emergency battery transformer to circuit supplying luminaire in the affected area.

.5 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 Proceed in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 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 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communications equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 TELEPHONE WIRE

.1 Service wire: 4 No. 22 AWG solid annealed copper conductors with polyethylene insulation, spiral four lay-up, inner jacket polyvinyl chloride, close serving of flat galvanized steel wire armour, outer jacket of polyvinyl chloride designed for buried service connections.

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 communications equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by communications equipment installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 00 10 – Electrical Installations General Requirements.

.2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.4 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits and pull boxes.

1.2 SYSTEM DESCRIPTION

.1 Pathways for communications systems includes both horizontal distribution pathways as well as vertical components to point of use.

.2 Empty telecommunications raceways system consists of outlet boxes, cover plates, distribution, cabinets, conduits, cable troughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

.3 Overhead J-Hook distribution system.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIAL

.1 Conduits: EMT type in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Junction boxes, cabinets: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

2.2 NON-CONTINUOUS CABLE SUPPORT SYSTEMS (J-HOOKS)

.1 J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables per ANSI/TIA 568.0-D

.2 J-hooks shall have flared edges to prevent damage while installing cables.

.3 J-hooks shall have a cable retainer to provide containment of cables within the hanger. The cable retainer shall be removable and reusable.

.4 J-hooks shall have a hot-dipped galvanized or G60 finish and shall be rated for indoor use in noncorrosive environments.

.5 Base material of the J-hooks shall be metal (at least a 0.052" thickness) and not plastic or other similar material that will potentially fail to support cabling in a fire event. Any fasteners used to affix the HPNCCS shall also be metal and shall be fastened to the metal of the HPNCCS support. This is to provide added safety to building occupants and emergency responders in areas of egress to ensure that the cabling remains in the pathway in the ceiling during a fire event.

Part 3 Execution

.1 Install empty raceway system, including distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, service poles, miscellaneous and positioning material to constitute complete system.

.2 J-hooks are permitted in ceiling space. Conduits to be used within walls and surface work. Use a dedicated loop for each system.

.3 Install cables without damaging conductors, shield, or jacket

.4 Do not exceed load ratings specified by manufacturer.

.5 Follow manufacturer's recommendations for allowable fill capacity for each size of J-hooks.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 214-, latest revision, Communications Cables (Bi-National standard with UL 444).

.2 CSA-C22.2 No. 232, latest revision, Optical Fiber Cables.

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-568-B.1, latest revision, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.

.2 TIA/EIA-568-B.2, latest revision, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.

.3 TIA/EIA-568-B.3, latest revision, Optical Fiber Cabling Components Standard.

.4 TIA/EIA-606-A, latest revision, Administration Standard for the Commercial Telecommunications Infrastructure.

.5 TIA TSB-140, latest revision, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

.6 TIA-598-C, latest revision, Optical Fiber Cable Color Coding.

1.2 DEFINITIONS

.1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.3 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fiber cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 All cabling, termination hardware and connecting cords to be sourced from a certifying manufacturer to assure quality control.

.3 Upon completion of the installation, the system must be certified by a qualified installer and the manufacturer that it will support Category 6 applications. The installer must also

have experience in testing fibre optic cabling systems including the use of a light meter and OTDR.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 FOUR-PAIR 100 Ω BALANCED TWISTED PAIR CABLE

.1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or CMP to: CSA-C22.2 No. 214, Category 6 (Cat 6) to: TIA/EIA-568-B.2.

.2 Cable jacket colours to be as follows refer to 26 00 53 Identification for electrical systems (confirm with owner):

.3 Acceptable manufacturer or approved equal:

.1 Category 6 (Cat 6), FT6:

.1 Belden DataTwist #2413.

.2 Panduit #PUP6C04.

.3 Systimax GigaSPEED XL #2071E.

.4

2.2 WORK AREA UTP 4-PAIR MODULAR JACK

.1 Eight-position modular jack ("RJ-45"), type T568A, Category 6 to TIA/EIA-568-C.2:

.1 MDVO style.

.2 Punch down UTP connector.

.3 Modular jack colours to be as follows:

.1 Data: yellow.

.2 Voice (telephone): white.

.4 Acceptable manufacturer or approved equal:

.1 Category 6 (Cat 6):

.2 Belden #CAT6+ MDVO.

.3 Panduit #CJ688TGx.

.4 Systimax GigaSPEED XL #MGS400.

.2 Provide compatible single gang faceplates as follows:

.1 Flush entry, number of jack positions per faceplate as required.

.2 Top and bottom labeling windows for jack identification.

.3 Faceplate color: white.

.4 Acceptable manufacturer or approved equal:

.1 Faceplates:

.1 Belden MDVO faceplate with ID window.

.2 Panduit #CFPExxY.

.3 Systimax #M1xLE.

.3 Interface faceplates located in kitchen areas to be stainless steel.

.4 Provide self-contained white surface-mount box where indicated and as required, two (2) jack positions per box complete with modular jacks to suit.

2.3 MALE PLUG CONNECTOR

.1 Male plug connectors to mate with “RJ-45” jacks, Cat 6 for CCVE camera cables.

2.4 TELEPHONE RISER CABLE

.1 25-PR Category 5E (Cat 5E) backbone cable, gray colour, FT6.

.2 Use four 25-PR cables to achieve a 100-PR riser.

.3 Acceptable manufacturer or approved equal:

.1 Belden.

.2 Panduit.

.3 Hubbell.

2.5 TELEPHONE OUTLETS

.1 Eight (8) conductor jacks as indicated.

.2 Fully compliant with all requirements for category 6.

.3 White, 4 port angled entry faceplate with lamacoid identification label.

.4 Suitable for flush mounting as indicated, colors to match receptacle and switch cover plates.

.5 Acceptable manufacturers:

.1 Panduit # mini-com classic series or approved equal by Belden/CDT or Ortronics.

2.6 EQUIPMENT CORDS

.1 3 metres long, each end equipped with "RJ-45" plug Category 6 to: TIA/EIA-568-B.2.

.2 UTP work area cord colour to match horizontal cable colour for application; i.e. data.

.3 Acceptable manufacturer or approved equal:

.1 Belden CAT6+.

.2 Panduit TX6 PLUS.

.3 Systimax GigaSPEED XL.

Part 3 Execution

3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE

.1 Install termination and cross-connect hardware in rack as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-A.

.2 Install consolidation points, as indicated according to manufacturer's instructions. Identify and label as indicated to: TIA/EIA-606-A.

3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install horizontal cables in pathways in accordance with Section 27 05 28 – Pathways for Communications Systems.

.1 Identify and label as indicated to: TIA/EIA-606-B.

.2 Routing of cables must be such that total length does not exceed 90 m.

.3 Leave sufficient tail at each end for termination of cable.

.4 Terminate horizontal cables in telecommunications room and at individual work-area jacks using T568A pin assignment. The amount of untwisting in a cable pair to terminate to be no greater than 13 mm.

.1 Identify and label as indicated to: TIA/EIA-606-B.

.5 Each horizontal cable to have identification markers installed on both ends.

.6 Each modular jack to be identified with an alpha/numeric label.

.7 Labeling to indicate rack number, patch panel letter and outlet number (i.e. 1A48 is rack 1, patch panel A, outlet 48).

.8 Identification is to be consistent with existing identification method.

.9 Where a cable terminates at a jack which is concealed within accessible ceiling space, provide a coloured adhesive dot on the T-bar or ceiling below to indicate its location. Coordinate colour of dot with Owner and with identification of other systems.

.10 Coil spare cables and store in ceiling space in zone.

.11 Harness slack cable in cabinets, racks, and wall-mounted termination and cross-connection hardware.

3.3 INSTALLATION OF BACKBONE CABLES

.1 Install backbone cables from each telecommunications room to main terminal/equipment room (MT/ER) as indicated and according to manufacturers' instructions.

.1 Identify and label as indicated to: TIA/EIA-606-A.

.2 Install backbone cables from MT/ER to carrier demarcation point in [Entrance Room] as indicated and according to manufacturer's instructions.

.1 Identify and label as indicated to: TIA/EIA-606-A.

.3 Each backbone cable to have identification markers installed on both ends.

3.4 IMPLEMENT CROSS-CONNECTIONS

.1 Implement cross-connections using patch cords as specified.

3.5 FIELD QUALITY CONTROL

.1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as hard copy and electronic record on usb stick.

.1 Perform tests for Permanent Link on installed cables, including spares:

.1 Category 5e using certified level IIe tester to: TIA/EIA-568-B.1.

.2 Category 6 using certified level III tester to: TIA/EIA-568-B.2.

.2 Perform tests for Channel on 20% of cross-connected data horizontal cabling installed from each telecommunications room, including shortest and longest drops from each telecommunications room: should more than 5% of tested cables fail, test remaining cross-connected data cables.

.1 Category 5e using certified level IIe tester to: TIA/EIA-568-B.1.

.2 Category 6 using certified level III tester to: TIA/EIA-568-B.2.

.2 Provide record of results as hard copy and electronic record on usb stick to: TIA/TSB-140.

.3 Test backbone cables as specified below and correct deficiencies: provide record of results as hard copy and electronic record on usb stick.

.1 Perform tests for Permanent Link on 4-pair cables:

.1 Category 6 using certified level III tester to: TIA/EIA-568-B.2.

.2 Perform Wire Map tests on multi-pair UTP cables to: TIA/EIA-568-B.1.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 27 10 06 – Communication Cable Inside Building.

.2 Section 27 00 10 – Communication Installations General Requirements.

1.2 REFERENCES, STANDARDS AND CODES

.1 As minimum standards, product and installation to:

.1 ANSI-J-STD-607-A-2002: Commercial Building Grounding and Bonding Requirements for Telecommunications.

.2 Canadian Electrical Code, Part 1.

.3 ANSI/TIA/EIA-606-A.2002: Administration Standard for Commercial Telecommunications Infrastructure.

.4 BICSI TDMM 10th edition.

.5 CAN/CSA-T527, latest revision, Grounding and Bonding for Telecommunications in Commercial Buildings.

.6 CAN/CSA-T530, latest revision, Building Facilities, Design Guidelines for Telecommunications.

1.3 SYSTEM DESCRIPTION

.1 The Telephone and Data system consist of bix panel, patch panels and equipment racks.

.2 The Data system consists of outlet, boxes, coverplates, conduits, pull boxes, sleeves and caps, fish wires, cables, cable tray, floor mounted rack and patch panel.

.3 Incoming cable of telephone entrance to communication room will be by Aliant. All cross connections between utility voice patch panel and customer patch panel shall be done by Aliant.

.4 Quality Assurance:

.1 Data and voice cabling, terminations and testing shall be performed by an end to end “Certified System Vendor”, or “Factory Authorized Contractor”, and shall be “IBDN Certified”, and have a 25 year passive component guaranty.

.2 Upon completion of the installation, the system must be certified by the installer and the manufacturer that it will meet or exceed Category 6 and 1000 Base T applications for voice and data.

1.4 COORDINATION WITH TELEPHONE AUTHORITIES

.1 Coordinate with Owner for exact location of service from switch and access for site survey.

PART 2 Products

2.1 PATCH PANELS CABINETS AND RACKS

.1 Provide cross connect Bix Mount patch panel for voice:
- .1 25 pair bix mounts for cat 6, wall mounted c/w distribution rings.
- .2 16 gauge steel.
- .3 Beige powder paint finish
- .4 Fire-retardant thermoplastic fanning strip material.
- .5 Cable management rings.
- .6 Acceptable manufacturers:
  - .1 Belden
  - .2 Panduit
  - .3 Hubbell
  - .4 Avaya

.2 Connector Strips for Bix Mount patch panel
- .1 Bix distribution connector.
- .2 25 pair.
- .3 Fire-retardant thermoplastic material.
- .4 IDC clip: Copper alloy with tin plating over nickel.
- .5 Quantity: as required, plus 1 spare.
- .6 Acceptable manufacturers:
  - .1 Belden
  - .2 Panduit
  - .3 Hubbell
  - .4 Avaya

.3 UTP Patch Panels for DATA
- .1 UTP patch panel for copper
  - .1 Categroy 6 rated.
  - .2 48-port or 24 port, flex style, blank panel as shown.
  - .3 1.6mm steel, black finish.
  - .4 Complete with Gigaflex PS6+ modules as required.
  - .5 Acceptable manufacturers:
    - .1 Belden
    - .2 Panduit
    - .3 Hubbell
    - .4 Avaya
- .2 UTP patch panel for fiber
  - .1 Fiber express, 12/24 port (lu) rack mount patch panel
  - .2 14 gauge steel, black finish.

.3 Complete with double density secure/keyed [LC] adapter strip as required, and black strips to fill unused adapter strip openings.

.4 Acceptable manufacturers:

.1 Belden

.2 Panduit

.3 Hubbell

.4 Avaya

.3 Patch panels identifications

.1 Front and rear port identification complete with labels, mounting screws and installation sheets.

2.2 DATA RACK

.1 Pivital wall rack such as Middle Atlantic DWR Series.

.2 24RU,

.3 32” deep

.4 Rack mounted black powder coated ventilated shelves to be provided as follows:

.1 2U Rack space, 483 mm wide x 375 mm deep, quantity: 1 per rack.

.2 2U Rack space, sliding rackshelf, four point mounting, 90.7 kg capacity, 483 mm wide x 714 mm deep, quantity: 1 per rack.

.5 Rack mounted horizontal power strip, one front and eight rear 5-20R outlets, power switch/circuit breaker on front, 2.74 m power cord, quantity: 1 per rack.

.6 Acceptable manufacturer or approved equal:

.1 Middle Atlantic.

.2 Belden.

.3 Panduit Net-Access N-Type Cabinet.

.4 Systimax.

2.3 POWER BAR

.1 Rackmountable power bar

.1 Eight (8) rear outlets and one (1) front outlets, 15A 120V U-ground.

.2 MOV surge and spike protection.

.3 EMI filtering.

.4 Illuminated combination power switch/circuit breaker.

.5 2740 mm cord.

.6 Black powder coat finish.

.7 Complete with associated mounting equipment for rack side mount.

.8 Acceptable manufacturer:

.1 Middle Atlantic

.2 Panduit

.3 Hubbell

.4 Wiremold

2.4 IDENTIFICATION

.1 Each modular jack to be identified with an alpha/numeric label

.1 Acceptable manufacturer or approved equal:

.1 Panduit

.2 Hubbell

.2 Each patch panels and equipment racks to have corresponding labeling.

PART 3 Execution

3.1 LABELLING

.1 A structured alpha numeric system will uniquely identify each component of the UTP cabling system.

.1 RJ45 patch panel ports located in the communications room are to be labeled from 01 to 06.

.2 Both ends of each data cable shall be labeled with the room ID and the patch panel port ID to which it is connected. The labels should be placed 6 to 12 inches from each jack or connector and secured with shrink wrap.

.3 Each installed RJ45 jack shall be labeled with the room ID and the patch panel port ID to which it is connected.

.2 All labels must be machine made and of professional quality. No hand-written identification will be accepted. All patch cord labels must be shrink wrapped to ensure permanent identification.

3.2 INSTALLATION OF RACKS AND EQUIPMENT

.1 Install rack in server room allowing adequate working clearance.

.2 Ground racks using # 6AWG wire back to electrical room panel.

.3 Install rack mounted patch panels and wire management ducts on racks.

.4 Route cables through wire management ducts and terminate on patch panels.

.5 Install rack mounted power bar with surge protection for user equipment.

.6 Install cabinets plumb, level, square, and secure.

.7 Anchor cabinets to floor for seismic restraint in accordance with manufacturer’s instructions.

.8 Spare space on data rack is reserved for the Owner’s equipment. Other system equipment not related to the data/telephone system is not to be installed in the data rack.

.9 Identify each cabinet with a size 4 engraved nameplate in accordance with Section 26 00 53 - Identification for Electrical Systems.

3.3 FIELD QUALITY CONTROL

.1 The same individual snap-in type modular connectors will be utilized at both ends of the cable. The connectors at the patch panel and at the jack must be of the same model and manufacturer.

.2 The installation technicians must be certified through a manufacturer's certification program and must be capable of providing evidence of their training certification. The contracting firm must supply documentation verifying their current participation in a manufacturer's certification program. Upon request and at no additional cost to Owner, the contactor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

.3 Upon request and at no additional cost to Owner, the contractor shall provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

.4 The manufacturer's certification must guarantee that design or installation negligence on the part of the certified contractor will not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and Labour are covered n this circumstances for the full certification period. It must also guarantee that in the event a contractor is no longer in business, the full certification remains valid.

.5 Written acknowledgement of these conditions must be provided prior to award of the contract.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Industry Canada - Terminal Attachment Program

.1 CS-03, latest revision, Compliance Specification.

.2 National Fire Protection Association (NFPA)

.1 NFPA72, latest revision, National Fire Alarm and Signaling Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for public address and mass notification systems 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 New Brunswick, Canada.

.2 Indicate on drawings:

.1 Riser diagram, block diagram of complete public address system.

.2 Public address system design criteria.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for public address and mass notification systems for incorporation into manual.

.3 Include in manual:

.1 Operation instructions.

.2 Description of system operation.

.3 Description of each subsystem operation.

.4 List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit maintenance materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect public address systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Public address loudspeaker system to incorporate:

.1 Wireless microphone system with remote antenna

.2 Recorded music from digital audio - MP3, WMA and AAC player.

.3 Additional features as specified.

.4 Speaker as indicated on drawings

.2 Operations:

.1 Paging:

.1 Wireless microphone system

.2 Selective area page to areas as indicated.

.3 Emergency page to all areas.

.4 Schedules page for breaks and lunch time.

.2 Music:

.1 Music from MP3 player or external source.

.2 Speaker selection made via solid-state assembly.

.3 Systems in various configurations to be rack mounted.

2.2 MATERIALS

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Communication conductors: as recommended by manufacturer.

.3 As indicated in on drawings and in this section.

.4 Provide back box and mounting channels for ceiling mounted speakers. All speaker must be supported independently, and are not to be reliant on drywall or ceiling tile for their support.

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 public address systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install equipment in accordance with manufacturer's instructions, and as indicated.

.2 Install wiring in J-hook where cable can be concealed and in EMT when cable cannot be

.3 Install all wiring in conduits as per Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings when cables are exposed or in electrical room and in J-Hooks otherwise.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Conduct intelligibility test.

3.4 CLOSEOUT ACTIVITIES

.1 Manufacturer's factory service engineer to instruct:

.1 Maintenance personnel in maintenance of system.

.2 Operating personnel in use of system.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by public address and mass notification systems installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S304, latest revision, Signal Receiving Centre and Premise Burglar Alarm Control Units.

.2 CAN/ULC-S306, latest revision, Intrusion Detection Units.

.3 ULC-S318, latest revision, Standard for Power Supplies for Burglar Alarm Systems.

.4 ULC-C634, latest revision, Guide for the Investigation of Connectors and Switches for Use with Burglar Alarm Systems.

.3 Underwriters' Laboratories (UL)

.1 UL 603, latest revision, Power Supplies for Use with Burglar-Alarm Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for control panels, detection accessory devices and door access accessory and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Submit:

.1 Functional description of equipment.

.2 Technical data for devices.

.3 Device location plans and cable lists.

.4 Devices mounting location detail drawings.

.5 Typical devices connection detail drawings.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.

.2 Shop drawings to indicate project layout, mounting heights and locations, wiring diagrams, detection device coverage patterns and contact operating gaps.

.3 Submit zone layout drawing indicating number and location of zones and areas covered.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Submit UL Product Safety Certificates.

.2 Submit verification Certificate that service company is ULC/UL List alarm service company.

.3 Submit verification Certificate that intrusion alarm system is Certified Alarm System.

.5 Test and Evaluation Reports:

.1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

.7 Manufacturer's Field Reports: submit manufacturer's written reports within [3] days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit maintenance data for incorporation into manual specified in Section 26 00 10 – Electrical Installations General Requirements.

.1 Include:

.1 System configuration and equipment physical layout.

.2 Functional description of equipment.

.3 Instructions of operation of equipment.

.4 Illustrations and diagrams to supplement procedures.

.5 Operation instructions provided by manufacturer.

.6 Cleaning instructions.

.7 Systems verification report

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect intrusion detection from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.5 WARRANTY

.1 For materials the 12 month warranty period prescribed in subsection GC 32.1 of General Conditions is extended to 60 months.

.2 Project Warranty: refer to CCDC for project warranty provisions.

.3 Extended warranty period must include warranty against defects meeting specified performance requirements, for specified time period.

.4 Manufacturer's Warranty: submit, for Consultant's acceptance, manufacturer's standard warranty document executed by authorized company official.

.1 Include manufacturer/dealer recommendations, information and support services for 1 years.

Part 2 Products

2.1 MATERIALS

.1 Design Criteria:

.1 Design intrusion detection system using only ULC/UL listed products.

.2 Design intrusion detection system using ULC/UL listed alarm service company, company specializing in intrusion detection systems.

.3 Design intrusion detection system as a ULC/UL certified alarm system.

.4 Design system as a modular access control, alarm monitoring system expandable, and easily modified for inputs, outputs and remote control stations.

.1 Design components in accordance with CAN/ULC-S306 and be capable of:

.1 Annunciating undesirable, abnormal or dangerous condition.

.2 Prioritizing alarms by alarm type; i.e. panic/duress, intrusion and tamper.

.3 Determining zone where alarm occurred.

.4 Annunciating power failure and power restoration.

.5 Annunciating low battery condition.

.6 Operate continuously for minimum period of 4 hours in the event of a power failure.

.7 Operates the access of building doors through the use of card readers as indicated on drawing.

.5 Equip control panels with continuous tamper detection on door and wall.

.1 Tamper detection to trigger trouble light.

.6 Design system with:

.1 Alarm masking.

.2 Remote maintenance or diagnostics with password activation and callback modem.

.3 Unique identifier for each authorized person.

.4 Arming and disarming capabilities: manual and automatic by time of day, day of week, or by operator command.

.5 Support both manual and automatic responses to alarms entering system.

.6 Each alarm capable of initiating different functions of camera, homing, and activation of remote devices, audio switching, door control and card or pin validation.

.7 Zone or alarm location annunciated at monitoring station.

.7 Communications link: security level of III to CAN/ULC-S304.

.8 Signal link: security level of II to CAN/ULC-S304.

.9 Alarm condition: design system to provide maximum time for an alarm to be communicated of 90 seconds from alarm initiation to annunciation at remote monitoring location.

.10 Junction boxes: tamper proof with continuous tamper-detection capability.

.11 Design system power supplies rated to provide cumulative load of all systems components plus safety factor of 50% or greater.

.2 Control Panel: ULC approved, expandable and designed for multiplexed expansion.

.1 Zones (protection inputs): as required.

.2 Zones expandable

.3 Number of user codes required: standard.

.4 Number of areas/partitions required: standard.

.5 Keypads: LCD (liquid crystal display).

.6 Alarm: monitored.

.7 System: wired.

.8 Integrated with sub systems: Fire alarm.

.9 Number of programmable outputs required: standard.

.10 System supervision: telephone line, battery, AC power.

.11 Siren output.

.12 Number of devices per zone: 1 device per zone.

.3 Detection Accessories:

.1 Passive Infrared Detectors (PIR's): ULC approved, digital.

.1 Coverage pattern: standard.

.2 Temperature requirement: standard.

.3 Tamper switch.

.4 Mounting: wall and ceiling.

.2 Dual passive infrared and microwave: ULC approved, complete with tamperproof switch, and be designed to meet temperature and mounting requirements of project.

.1 Coverage pattern: standard.

.3 Contacts : ULC approved.

.1 Mounting: surface.

.2 Mounting locations: refer to drawings.

.3 Operating gap: standard.

.4 Security level: high security.

.5 Type: magnetic.

.1 Communications: telephone line dialer.

.2 Connectors and switches: to ULC-C634.

.3 Power supplies: to ULC-S318.

.4 Acceptable product:

.1 DSC Neo power series or approved equivalent.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for intrusion detection installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install panels, intrusion detection system and components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.

.2 Install panels, intrusion detection system and components secure to walls, ceilings or other substrates.

.3 Install required boxes in inconspicuous accessible locations.

.4 All wiring shall be installed in conduit as per Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings. Conceal conduit and wiring.

3.3 SITE TEST AND INSPECTION

.1 Perform verification inspections and test in the presence of Consultant.

.1 Provide necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors , and manufacturer's representatives and security specialists are present for verification.

.2 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

.1 Sturdiness of equipment fastening.

.2 Non-existence of installation related damages.

.3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.7 Application and location of ULC approval decals.

.3 Technical verification: purpose to ensure that all systems and devices are properly install and free of defects and damage. Technical verification includes:

.1 Measurements of coverage patterns

.2 Connecting joints and equipment fastening.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

.4 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:

.1 Operation of each device individually and within its environment.

.2 Operation of each device in relation with programmable schedule and or/specific functions.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Ensure manufacturer's representative is present before and during critical periods of installation and testing.

3.5 ADJUSTING

.1 Adjust all components for correct function.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove protective coverings from accessories and components.

.2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by intrusion detection installation.

3.8 TRAINING

.1 Provide four (4) hours of on-site lectures and demonstration by security equipment manufacturers to train operational personnel in use of maintenance of the Security systems. Training shall be Bilingual

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ULC-S317, latest revision, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems.

1.2 SYSTEM DESCRIPTION

.1 Provide a complete, closed-circuit colour television system, (CCTV), including controller, IP cameras, monitor, two (2) weeks storage capacity at 15-30 fps recording Provide wiring and accessories as per manufacturer's recommendations.

.2 Provide services of manufacturer's technician to connect, calibrate, and adjust system and to provide two (2) training sessions of four-hour duration for operating and maintenance personnel designated by Owner. Provide memory stick with maintenance training and set-up. First session is to take place prior to occupancy. Allow for call back for remaining training sessions anytime within the first three (3) months.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

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

.2 Submit:

.1 Functional description of equipment.

.2 Technical data sheets of all devices.

.3 Device location plans and cable lists.

.4 Video camera surveillance chart.

.5 Video interconnection detail drawings.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of NB, Canada.

.2 Submit shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labeling scheme.

.3 Submit zone layout drawings indicating number and location of zones and areas covered.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Submit UL Product safety Certificates.

.2 Submit verification Certificate that service company is "UL List alarm service company".

.3 Submit verification Certificate that monitoring facility is "UL Listed central station".

.4 Submit verification Certificate that video surveillance system is "Certified alarm system".

.5 Test and Evaluation Reports:

.1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

.7 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit maintenance data for incorporation into manual specified in Section 26 00 10 – Electrical Installations General Requirements. Include following:

.1 System configuration and equipment physical layout.

.2 Functional description of equipment.

.3 Manufacturer's Instructions for operation, adjustment and cleaning.

.4 Illustrations and diagrams to supplement procedures.

.5 System verification report

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and 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, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect video surveillance materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.6 WARRANTY

.1 For video surveillance materials the 12 month warranty period prescribed in the General Conditions is extended to 60 months.

.2 The System Installer shall provide a warranty on the system, which shall include all necessary labor and equipment to maintain the system in full operation for a period of one year from the date of acceptance.

.3 Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of five (1) years, beginning on the turnover of equipment to the owner. Installation of system upgrade software shall be by the System Supplier and shall be per the labor warranty specified here-in.

.4 On-site service shall be provided at no cost to the purchaser during the guarantee period, unless damage or failure is caused by misuse, abuse, neglect or accident.

.5 The service shall be provided in both languages (English or French) as requested by owner.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Camera system must be POE based

.2 Support: camera functions such as pan/tilt and zoom fully supported by Closed Circuit Television (CCTV) system.

.1 Provide operator with ability to control all camera functions.

.3 Switching:

.1 Provision to switch any camera in system to any monitor in system manually or automatically.

.2 Provision to switch system video recorders to selective monitor outputs in system.

.4 Control: provision for any camera equipped with pan, tilt,:

.1 Manually control pan, tilt and lens functions.

.2 Set pan and tilt home position.

.3 Set and clear movement limits of pan and tilt mechanism.

.5 Enter and edit CCTV programs and save them for future use.

.6 Set dwell time for viewing of any camera picture.

.7 Define sequence for viewing cameras on each monitor.

.8 Bypass cameras in system during sequencing to monitor.

.9 Provide ability to display stored 'video image' of cardholder, and switch real-time camera to card reader location for specific card usage.

.10 Overall control of CCTV provided through software control, which provides complete integration of security components.

.11 Environment: design video components and systems to operate with specified requirements under following ambient temperatures:

.1 Indoor installations:

.1 Temperature: 0 degrees C to 30 degrees C.

.2 Humidity: 10 to 90%.

.2 Outdoor installations:

.1 Temperature: -40 degrees C to 60 degrees C.

.2 Humidity: 10 to 100%.

2.2 CHARACTERISTICS

.1 Video Camera:

.1 Image quality:

.1 Outside: 1080p resolution, four (4) megapixels minimum.

.2 Environment: outdoor IP66 enclosure rating equipped with heater/blower (if required to meet temperature spec

.3 ONVIF compatible.

.4 Lens functions: varifocal lenses.

.5 Additional features: backlight compensation.

.6 Operational voltage: standard POE.

.7 Vandal resistant.

.8 Mounting arms to be included.

.9 Acceptable Manufacturer:

.1 Such as Hikvision DS Series or equivalent

.2 Monitor:

.1 Colour LCD Monitor.

.2 Power Requirements: 120V, 60Hz, 100W (max operating)

.3 21” flat screen LCD monitor c/w front panel controls, video and audio input and output and digital comb filter.

.4 Display 1, 4, 9 or 16 cameras simultaneously.

.5 On screen pan/tilt/zoom control.

.6 Rack mountable

.7 Resolution: 1920 x 1080 (FULL HD)

.8 Acceptable Manufacturer:

.1 Dell or equivalent.

.3 Recorder:

.1 Motion detection.

.2 Image compression : H.264.

.3 Eight (8) camera channels.

.4 Recording mode: 15-30 fps motion detection (based on camera location and manufacturer’s recommendations)

.5 On screen pan/tilt/zoom control.

.6 Playback search: multiple enhanced search capabilities.

.7 Back-up: DVD ± RW, network, USB 2.0, 3.0, eSATA.

.8 Rack mountable.

.9 Storage capacity based on cameras selected for recording 2 weeks of footage; RAID 5 storage.

.10 Must not have proprietary software.

.11 One (1) year warranty.

.12 Provided c/w quantity of camera licenses required for project and 20% spare.

.13 Server based and must support web access and mobile access.

.14 Acceptable Manufacturer:

.1 Such as Hikvision #DS-7608NI-I2/8P or equivalent

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheet.

.2 Install video surveillance equipment and components in accordance with ULC-S317.

.3 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.

.4 Run all cable in concealed conduit where exposed, j-hooks where conceiled. The cable length should not exceed 90 meters. Fibers shall be used if length is greater 90m.

.5 Install components secure, properly aligned and in locations shown on reviewed shop drawings.

.6 Make all network connections and configurations.

.7 Make all adjustments to installed equipment including orientation and aiming.

.8 Connect cameras to cabling in accordance with installation instructions.

.9 Supply and install all necessary mounting hardware for system.

.10 Final programming and/or identification shall location name as assigned by the users. Do not use room numbers or names from contract drawings unless advised otherwise.

.11 Install ULC labels where required.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Obtain reports, within three (3) days of review, and submit, immediately, to Consultant/Owner.

3.4 SYSTEM STARTUP

.1 Perform verification inspections and test in the presence of Consultant.

.1 Provide all necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors , and manufacturer's are present for verification.

.2 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

.1 Sturdiness of equipment fastening.

.2 Non-existence of installation related damages.

.3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.7 Application and location of ULC approval decals.

.3 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of tension and power.

.2 Connecting joints and equipment fastening.

.3 Measurements of signals (dB, lux, baud rate, etc).

.4 Test complete system including, control, signal strength, picture quality, and camera coverage

.5 Compliance with manufacturer's specification, product literature and installation instructions.

.4 Commissioning: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Commissioning includes:

.1 Operation of each device individually and within its environment.

.2 Operation of each device in relation with programmable schedule and or/specific functions.

.3 Operation control of camera lens, pan, tilt and zoom.

.4 Switching of camera to any monitor.

.5 Switching of system video recorder to selective monitor.

.6 Set dwell times.

.7 Demonstrate:

.1 Sequence viewing of cameras on each monitor.

.2 Bypass capability.

3.5 ADJUSTING

.1 Remove protective coverings from cameras and components.

.2 Adjust cameras for correct function.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove protective coverings from accessories and components.

.2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by video surveillance installation.

3.8 TRAINING

.1 Provide four (4) hours of training to ensure that operating personnel are capable of proper operation of the systems. All training shall be Bilingual (French and English).

.2 All cost associated with final commissioning system shall be included in the contractor’s tender price

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 23 33.01 - Excavation, Trenching and Backfilling.

1.2 REFERENCES

.1 ASTM International

.1 ASTM D698-07e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

1.3 EXISTING CONDITIONS

.1 Examine geotechnical investigation report which is appended.

.2 Known underground and surface utility lines and buried objects are as indicated on site plan.

.3 Establish precise location of underground services before commencing work.

.4 Examine drainage requirements.

1.4 PROTECTION

.1 Protect existing site features which are indicated to remain. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris and mud on roads.

.3 Clean affected areas of adjacent municipal roads regularly in accordance with General Requirements.

Part 2 Products

2.1 MATERIALS

.1 Fill material: in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Consultant.

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 rough grading installation in accordance with manufacturer's written instructions.

3.2 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of area after area has been cleared of existing structures and debris has been removed from site.

.2 Organize stockpiles in locations within existing limit of contract; locations designated.

.3 Dispose of unused material on site.

.4 Salvaged existing topsoil may only be used for common area topsoil.

3.3 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

- .1 150 mm for common grasses and meadow areas.
- .2 250 mm for running tracks.
- .3 150 mm for playing field outfields.
- .4 250 mm for crusher dust trails and aprons.
- .5 600mm for gravel parking and access road
- .6 850mm for splash pad and rink
- .7 325mm for concrete paving
- .8 Deeper as required to accommodate drainage system indicated.

.3 Grade ditches to depth indicated.

.4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.5 Compact filled and disturbed areas to Modified Proctor density as follows:

- .1 85% under landscaped areas.
- .2 95% under paved and walk areas.

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.4 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid by Owner.

.2 Submit testing procedure, frequency of tests, testing laboratory as designated by ULC or certified testing personnel to Consultant for review.

3.5 QUALITY CONTROL

.1 Refer to Section 01 45 00 Quality Control.

.2 The Contractor shall survey shaped subgrade within area described by the detail playfield layout, along trails and swales upon completion and prior to placement of finish grading material.

.3 Provide results to the Consultant for review.

.4 Make adjustments or revisions as directed by the Consultant.

.5 Provide additional or re-checked grades as required by the Consultant.

.6 Quality control grade survey may be completed in logically organized sections based on approval by the Consultant.

3.6 DUST CONTROL

.1 Take necessary measures to minimize air born dust generated.

.2 Take immediate remedial dust control measures upon notification by the Owner or the Consultant.

.3 Manage all operations in a neighbourly manner.

3.7 SURPLUS MATERIAL

.1 Keep surplus material and material unsuitable for fill, grading or landscaping on site in areas as directed.

3.8 CLEANING

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

3.9 PROTECTION

.1 Protect existing trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

1.1 RELATED SECTIONS

.1 Section 01 30 00 – Administrative Requirements.

1.2 REFERENCE DOCUMENTS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A123 / A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.2 ASTM A307-14e1, Standar Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.3 ASTM A500 / A500-21, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

.4 ASTM F3125 / F3125M-19a2, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

.2 Canadian Standards Association (CSA International)

.1 CSA G40.20-13 / G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.

.2 CSA S16-19, Design of Steel Structures.

.3 CSA S478-19, Durability in buildings.

.4 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel

.5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.

.6 CSA W59-18, Welded Steel Construction.

.3 Canadian Geotechnical Society:

.1 Canadian Foundation Engineering Manual, 4th Edition, 2006.

1.3 QUALIFICATIONS/CERTIFICATIONS

.1 Engage a professional structural engineer registered or licensed in the Province of New Brunswick, fully qualified and experienced in the design of helical screw piles, to be responsible for the design of and supervision of installing these piles.

.2 The Piling Contractor shall be certified under the Canadian Construction Materials Center (CCMC), part of the National Research Council of Canada, and shall provide proof of certification to the Departmental Representative.

.3 The Piling Contractor performing the Work of this Section shall have been regularly engaged in screw pile work for a period of not less than five (2) years and shall be properly equipped to execute the Work with experienced and trained personnel.

1.4 DESIGN

.1 Pile design to be based on Limit States Design approach and designed to conform to the National Building Code of Canada 2015 and to resist minimum loads as indicated on drawings.

.1 The piles and their attachments/hardware shall be anchored to resist uplift as per requirements of the National Building Code of Canada 2015 and loads as indicated on drawings.

.2 Pile type and size are to be designed by the Piling Contractor and by an engineer registered in the Province of New Brunswick.

.2 Geotechnical resistance factors as per the Canadian Foundation Engineering Manual.

.3 Piles shall have a minimum embedment/frost cover of 2440 mm.

.4 Submit pile design criteria to the Consultant for review purposes only.

1.5 QUALITY CONTROL

.1 The Piling Contractor's professional engineer is responsible for this work and is to inspect the fabrication and installation of piles on behalf of the Piling Contractor.

.2 Perform steel work in accordance with the requirements of CSA S16 unless noted otherwise.

.3 Screw pile foundation to be designed with sufficient corrosion resistance for a minimum service life of

.1 75 years ("Long life" per CSA S478).

1.6 SUBMITTALS

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

.2 Prior to commencing the work, the Contractor's engineer is to submit documentation showing evidence of registration in the Province of New Brunswick as well as qualifications and experience. The Contractor's engineer is to further acknowledge in writing that he or she has reviewed the specifications and drawings and is aware that he or she is to inspect the fabrication and installation of the work and certify that the work is completed as specified.

.3 Product Data: submit manufacturer's printed product literature, specifications and datasheet.

.4 Mill Certificates: Submit three copies of certified mill test reports for the materials used.

.1 Where mill test reports originate from a mill outside of Canada or the United States of America, the Contractor shall have mill test reports verified by a certified laboratory in Canada by testing the material to the specified material standards, including boron content. The testing laboratory shall be certified to ISO/IEC 17025 by an organization accredited by the Standards Council of Canada for the tests required. Samples for testing shall be collected by personnel employed by the certified laboratory. A verification letter shall be provided by the certified laboratory that includes at a minimum, the applicable mill test reports, testing standards, date of verification testing, and declaration of material

compliance with Contract requirements. The verification letter shall be signed by an authorized officer of the certified laboratory.

.5 Calibration Report: Submit copies of certified calibration reports for torque measuring equipment and load test measuring equipment to be used on the project. The calibration shall have been performed within one year of the proposed pile installation date or as recommended by the equipment manufacturer.

.6 Shop Drawings:

.1 Clearly indicate the following information:

.1 Type of pile, sizes and details.

.2 Load capacity of each pile.

.3 Splice details.

.4 Proposed elevation of pile bases.

.5 Elevation of top of pile.

.6 Pile cap sizes and details.

.7 Type and grade of steel.

.8 Proposed hardware and attachment details and properties.

.2 Prepare shop drawings of piles under the seal and signature of the Piling Contractor's professional engineer responsible for the design.

.3 Review of the shop drawings by the Consultant is intended to assist the Contractor and does not relieve the Contractor of responsibility for the completeness and accuracy of the work and its conformance with the contract drawings and specifications.

.7 Pile installation report/records signed by a professional structural engineer registered or licensed in the Province of New Brunswick.

.1 Date and time of installation.

.2 Location of pile and pile identification number.

.3 Type of pile, sizes and details.

.4 Final load capacity and torsional resistance of each installed pile.

.5 Pile termination depth elevations, pile head depths and length of installed piles.

.6 Actual inclination of the piles.

.7 Comments pertaining to interruptions, obstructions, or other relevant information.

.8 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.9 Closeout submittals:

.1 Pile installation report/records signed by the Piling Contractor's professional engineer registered or licensed in the Province of New Brunswick.

.1 Date and time of installation.

.2 Location of pile and pile identification number.

.3 Type of pile, sizes and details.

.4 Final load capacity and torsional resistance of each installed pile.

.5 Pile termination depth elevations, pile head depths and length of installed piles.

.6 Actual inclination of the piles.

.7 Comments pertaining to interruptions, obstructions, or other relevant information.

1.7 EXISTING STRUCTURES, SERVICES AND UTILITIES

.1 Confirm and establish the locations and extents of all underground structures, services and utilities in the work area prior to commencement of piling work by notifying the applicable owners, authorities or agencies. Clearly mark such locations to prevent disturbance or damage.

.2 The Piling Contractor is to undertake a thorough inspection of existing structures and facilities and document any existing damage. The Piling Contractor will be responsible for repairs of any damage caused by piling operations.

1.8 QUALITY ASSURANCE

.1 Welding to conform to CSA W59 and all welders will hold welding certificates, issued by the Canadian Welding Bureau.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 30 00 – Standard General Requirements.

.2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

.3 Replace damaged piles as directed by the Consultant.

Part 2 Products

2.1 MATERIALS AND COMPONENTS

.1 Only new materials are to be used for the fabrication of screw piles.

.2 Steel pipe shaft: to ASTM A500, Grade C.

.3 Pile cap plates and helical plates: to CSA G40.21, Grade 300 min..

.4 Bolts: to ASTM A307 or ASTM F3125.

.5 Welding: to CSA W59 and W47.1 and certified by the Canadian Welding Bureau.

.6 Welding electrodes: to CSA W48 Series.

.7 All piles shall be installed open ended and ends shall be cut to 45°.

.8 Leading edge of helix shall be sharpened to minimize soil disturbance during installation.

.9 Helixes are to be formed to a “True Helix” shape. The helix must be formed such that it remains perpendicular to the pipe shaft (within ± 2°) during the entire distance around the pipe shaft.

.10 All edges on piles shall be ground and clear of burrs or sharp edges.

.11 Splice piles only with written approval of Consultant.

.1 When permitted, provide details for Consultant’s review.

.2 Design details of splice to dear dated seal and signature of professional engineer registered and licensed in the Province of New-Brunswick.

.3 Show all approved splices on the shop drawings.

.12 If required, Hot Dipped Galvanizing shall be completed by a qualified supplier complying with ASTM A123 for a minimum zinc coating of 610 g/m^2. The pile shall be galvanized inside and out and free from any galvanizing slag.

2.2 WELDING

.1 All pipe splicing shall be full strength complete penetration groove welds of the combination of a collar and continuous fillet welds on each end of collar to ensure continuity of pipe.

.2 Helix shall be welded to the pipe section using a continuous fillet weld on both sides of the helix to pipe connection.

.3 Welding procedure and welder qualification shall conform to CSA W59 and CSA 47.1.

Part 3 Execution

3.1 PREPARATION

.1 Protect adjacent structures, services and work of other sections from hazards due to pile drilled operations.

.2 Arrange sequencing of pile drilling operations and methods to avoid damages to adjacent existing structures.

.3 When damages occur, remedy damaged items to restore to original or better condition at Contractor’s expense.

3.2 INSTALLATION

.1 Notify the Consultant and inspection or testing firm at least 48 hours prior to any installations on site.

.2 Ensure that site conditions are adequate to support piling equipment and to allow proper performance of drilling operations.

.3 Ensure piling equipment is adequate for soil conditions. Piling Contractor is responsible for maintenance of the site grade and restoring any damages caused by the use of inappropriate equipment.

.4 Do not use piling methods that could cause damage to nearby or existing structures.

.5 The Contractor will adequately protect all materials and installed piles from the weather or physical abuse which may impair the quality, strength or usefulness of them. Items not so protected and suffering damage due to neglect by the Contractor in this regard will be rejected by the Consultant.

.6 Install piles where indicated on drawings.

.7 Should any obstruction be encountered in drilling pile which prevents pile from being placed to the expected tip elevation, or if drilled characteristics indicate that the pile is being damaged in drilled to the specified criteria, the pile will be abandoned or the pile will be removed. An abandoned pile will be cut off 600 mm below the pile cap soffit. An additional pile will be placed at an adjacent location, to be determined by the Consultant.

.8 Depth and torque tolerances: screw-in piles that reach maximum torque rating before reaching minimum indicated depth shall be subject to the following:

.1 Terminate at depth obtained with written approval of Consultant.

.2 Modify pile design with approval from Engineer of Record. Replace screw-in pile with smaller and/or fewer helix pile, installed beyond the termination depth of the original screw-in pile.

.9 Piles will be drilled without interruption until the lengths and drilling criteria shown and specified elsewhere in the Contract Documents are met.

.10 Construct all piles to the top of pile cut-off elevation.

.11 Piles will be cut-off normal to the pile axis at the elevation shown on the drawings.

.12 Discontinue piling operations and immediately notify Consultant in the event that unusual soil conditions are encountered such that pile load capacities cannot be obtained.

.13 Piles may be increased or decreased in length depending on soil conditions only as directed by the Consultant. Ensure that where pile lengths are increased or decreased, adjacent piles are not undermined or capacities are not reduced.

.14 The Contractor shall notify the Consultant immediately of any pile not in compliance with the drawings and these specifications.

.15 The Contractor will immediately notify the Consultant when any movement in an installed pile is detected, giving the reason for movement, such as heave due to adjacent piling, and the measures proposed to correct the movement.

.16 After erection, touch-up galvanized surfaces damaged during installation with zinc rich coating conforming to SSPC-Paint 20, zinc-rich coating and to ASTM A780

.17 All field welds, if required, shall be touch-up with zinc rich coating conforming to SSPC-Paint 20, zinc-rich coating and to ASTM A780.

.18 Pile attachments shall be adjustable in height for a minimum of ±25 mm.

3.3 EQUIPMENT AND ACCESSORIES

.1 The Contractor shall provide and operate all necessary equipment for installing the pile foundations. The Contractor will ensure that the piling equipment has sufficient torque to drill piles to design depths indicated on drawings for the work.

.2 Equipment:

.1 Using hydraulic drill head, install helical screw-in piles to depths, torques and positions as indicated on drawings or specifications.

.2 Provide torque monitoring device as part of the installation unit or as a separate in-line device capable of recording torque or line pressure. Calibrated torque monitoring data should be made available for review by the Consultant. Torque should be monitored during the entire installation.

.3 Torque head should be used that will provide more torque than the minimum required by the Consultant.

.4 Connect manufacturer’s approved adapters to the installation unit. Pin piers and extensions to the adapter in a safe and controlled manner, using two or more high strength pins. Install screw-in piles in a smooth and continuous manner, rate of advance 5 to 20 rpm. The rate of advance should match the pitch on the pile. Apply sufficient downward pressure to aid in the advancement of the pile into the ground.

.5 Use two high strength bolts with nuts per coupler connection or proper weld when welded connection is necessary.

3.4 INSTALLATION TOLERANCES

.1 Do not deviate from true vertical alignment by more than 2% of pile length.

.2 Do not deviate from centre of true location by more than 25 mm.

.3 Do not deviate from specified head elevations by more than 25 mm.

3.5 NON-CONFORMING PILES

.1 Non-conforming piles are piles that are placed out of position or are damaged and/or piles not conforming to size, length and material specifications.

.2 Provide additional piles or supplement piles with additional pile caps to meet specified requirements as directed by the Consultant at no additional cost to the contract.

3.6 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative in accordance with Section 01 30 00 - Standard General Requirements.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.

.3 Contractor shall be responsible for their own quality control. Inspection by an independent inspector, the Architect and/or the Engineer will not increase or replace Contractor quality control nor relieve them of their contractual responsibility.

3.7 CERTIFICATION

.1 Certify at completion of the work all installed by the Piling Contractor under the seal and signature of the Piling Contractor's professional engineer responsible for the work.

.2 Certify that all piles are capable of developing the capacities specified in the contract specifications and on the drawings.

.3 Certify that all piles are installed in accordance with the contract documents and the reviewed shop drawings.

3.8 CLEANING

.1 Clean in accordance with Section 01 00 02 – Standard General Requirements..

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

.2 Waste Management: Dispose of waste materials in accordance with Section 01 30 00 – Standard General Requirements.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 32 11 23 – Aggregate Base Courses
.2 Section 31 23 13 - Rough Grading.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM C 136-96a, Method for Sieve Analysis of Fine and Coarse Aggregates.
  .2 ASTM C 117-95, Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  .3 ASTM E 11-95, Specification for Wire - Cloth Sieves for Testing Purposes.
  .4 ASTM D 4318-98, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
  .5 ASTM D 698-91, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49-kg) Rammer and 12-in (304.8-mm) Drop.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 PROTECTION

.1 Prevent damage to buildings, landscaping, curbs, sidewalks, trees, fences, roads and adjacent property. Make good any damage.
.2 Provide access to building at all times. Coordinate paving schedule to minimize interference with normal use of premises.

Part 2 Products

2.1 MATERIALS

.1 Granular base:
  .1 As Per Section 32 11 23 – Aggregate Base Courses.
.2 Granular topping:
  .1 Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
  .2 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117.
  .3 Table

Sieve Designation	% Passing
9.5 mm	100

Sieve Designation	% Passing
4.75 mm	50-100
2.00 mm	30-65
0.425 mm	10-30
0.075 mm	5-10

Part 3 Execution

3.1 SUBGRADE

.1 Ensure that subgrade preparation conforms to levels and compaction required to allow for installation of granular base.

3.2 GRANULAR BASE

.1 Granular base material minimum thickness: 200 mm as indicated.

.2 Spread and compact granular base material in uniform layers not exceeding 100 mm compacted thickness.

.3 Compact to a density of not less than 98% Standard Density in accordance with ASTM D 698.

3.3 GRANULAR TOPPING

.1 Place granular topping to compacted thickness 100 mm as indicated.

.2 Place in layer of 50 mm compacted thickness. Compact layer to 95% Standard Density in accordance with ASTM D 698.

END OF SECTION

Part 1 General

1.1 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 furniture and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings indicating dimensions, sizes, assembly, anchorage and installation details for each furnishing specified.

1.2 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for care and cleaning of site furnishings for incorporation into manual specified in General Requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with General Requirements and 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect furnishings from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BENCH TYPE 1 (WITH BACK)

.1 Du Mor Site Furnishings

.2 Model number: 88 Series-PL 2AR

.3 Length: 1830mm (6’)

.4 Steel finish: polyester powder coating over zinc-rich epoxy

.5 Slats: nominal 76mm x 102mm (3”x4”) recycled plastic

.6 Legs: 3 x 76mm x 6mm (3” x ¼”) sq. steel tube

.7 Arms: 51mm x 6mm (2" x ½") steel bar

.8 Fasteners: stainless steel

.9 Overall Weight: 78kg (172 lbs)

.10 Color: To be selected from manufacturer's standard colour range.

.11 Support: Manufacturer's surface plate mounted.

.12 Or approved equivalent.

2.2 BIKE RACK

.1 DuMor Site Furnishings

.2 Model Number: 466-60

.3 Length: 52" long

.4 Width: 24" wide

.5 Capacity: 6 bikes

.6 Steel Finish: polyester powder coating over zinc-rich epoxy

.7 Frame: 38mm SCH 40 Steel Pipe and 25x50mm steel bar

.8 Slats: 12x25mm steel bar

.9 Weight: 156lbs

.10 Color: black

.11 Support: Freestanding installation

.12 Or approved equivalent.

2.3 WASTE RECEPTACLES

.1 DuMor Site Furnishings

.2 Model Number: 437-40

.3 Diameter: 28"

.4 Height: 43"

.5 Dual 20 gallon liners

.6 Cover: 437-40

.1 4" diameter hole with "Bottles and Cans" label

.2 5"x10" hole with "Trash" label

.7 Steel Finish: polyester powder coating over zinc-rich epoxy

.8 Weight: 217lbs

.9 Lid Color: Black

.10 Body Color: Black

.11 Support: Freestanding installation

.12 Or approved equivalent.

2.4 BLEACHERS

.1 Aluminum bleachers

.1 15 seat capacity

.2 3 rows of seats, 10” deep seats

.3 7.5’x5’x2’ dimensions

.4 Weight: 186 pounds

.5 Complete with mounting hardware for tailings and wood surfacing

.6 Uline H-7229 or approved alternate

.7 Quantity: 10

2.5 FIREPIT

.1 Pre-assembled kit consisting of precast concrete block and steel liner for firepit assembled as shown on plan.

.2 Shaw Brick Nantucket firepit kit.

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 exterior site furnishing installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied Consultant.

3.2 PREPARATION

.1 Locate and protect utility lines.

.2 Notify and acquire written acknowledgment from utility authorities before beginning installation Work

3.3 INSTALLATION

.1 Assemble furnishings in accordance with manufacturer's written recommendations.

.2 Install furnishing true, plumb, anchored as recommended by manufacturer.

.3 Touch-up damaged finishes to approval of Consultant.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with General Requirements.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with General Requirements.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by site furnishings installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 22 13 – Rough Grading.

.2 Section 32 92 19.16 – Hydraulic Seeding.

1.2 REFERENCES

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment

.1 PN1340 2005, Guidelines for Compost Quality.

1.3 DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.

.3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25)), and contain no toxic or growth inhibiting contaminates.

.4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide submittals indicated for review by the Consultant.

.3 Quality control submittals :

.1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described source quality control.

.2 The contractor is responsible for scheduling and the cost of soil testing.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.6 INSPECTION AND TESTING

.1 Inspection and testing of topsoil:

.1 Individual tests for pH value, sieve analysis and chemical analysis will be carried out by an approved independent laboratory testing company, and approved by the Consultant.

.2 Test existing to be reused and fabricated topsoil for pH, % organic content, cationic exchange capacity (CEC), nutrient levels for NPK, clay, and silt and sand content. The Contractor is responsible for his own soil testing costs.

.3 Inform Consultant of proposed source of topsoil to be supplied and provide access for sampling. If topsoil test results indicate amendments required, add recommended amendments and re-test soil. The contractor shall not commence work until topsoil is accepted by Consultant.

.4 Submit remedial action plan for amendments to salvaged topsoil prior to placing and spreading.

.2 Inspection and evaluation of topsoil fine grade:

.1 Inspection and evaluation of topsoil finish grade will be carried out by an independent survey technician. Submit results to Consultant for review. Cost of surveyor is the responsibility of the Contractor.

.2 The maximum tolerance from designed finish grade is 50 mm (2 inches) over 10 meters in all directions, on non playing surfaces.

.3 The maximum tolerance from designated finish grade is 13 mm (0.5 inches) over 10 meters in all directions on playing surfaces.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused soil amendments from landfill to official hazardous material collections site approved by Consultant

.2 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

.1 Mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.2 Submit texture test for review.

.3 Topsoil for seeded areas : mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 60 to 70 % sand, minimum 7 % clay, and contain 5 to 10 % organic matter by weight.

.2 Ph Value: 6.5 to 7.5

.3 Contain no toxic elements or growth inhibiting materials.

.4 Finished surface free from:

.1 Debris and stones over 12 mm diameter for playing surface and 25mm for other turn areas.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.5 Consistence: friable when moist.

.6 Double screen topsoil for playing surface to remove all stones over 12mm diameter.

.4 Planting Beds and Tree Pits:

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 30 to 70 % sand, 15-30% clay, and contain 5 to 20 % organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials or debris.

.3 Finished surface free from:

.1 Debris and stones over 50 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

.1 Mix all topsoil components and incorporate fertilizer, bone meal, lime, peat or compost and sand thoroughly and evenly. Pass through a 10 mm sieve for ballfield.

.2 Mix fertilizer into tilled existing topsoil at rate of 20kg/ha N at a ratio of 1-1-1.

.3 Compost:

.1 Meet condition 2.1.2.2. Compost must be tested by Agriculture Canada and written test results must be approved by the Consultant before mixing.

.4 Peat moss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous, brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

.5 Minimum organic content of 85 percent by weight as determined by loss on ignition (ASTMD 2974-87 Method D).

.6 Ensure peat is moist during the mixing stage to ensure uniform mixing and to minimize peat and sand separation.

.5 Sand: washed coarse silica sand, medium to course textured 100 percent below 1.0 mm, 65 percent below 0.5 mm, 25 percent below 0.25 mm and 5 percent below 0.05 mm.

.6 Limestone:

.1 Ground agricultural limestone containing minimum calcium carbonate equivalent of 85 %.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.3 All limestone in accordance with soil test to bring Ph value between 6.5 and 7.5 for sports field turf.

.7 Fertilizer:

.1 Complete commercial synthetic fertilizer with minimum 65 % insoluble nitrogen.

.2 At time of soil mixing, add 250 g of 0-20-10 fertilizer per cubic metre of mix.

2.3 SOURCE QUALITY CONTROL

.1 Advise Consultant of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Site shall be stripped and topsoil shall be stockpiled on site for re-use. Supplemental topsoil shall be imported as required.

.3 Contractor is responsible for amendments to supply topsoil as specified.

.4 Soil testing by recognized testing facility for PH, P and K, and organic matter.

.5 Testing of topsoil will be carried out by testing laboratory designated by Consultant.

.1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures around site perimeter and as directed on site to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as indicated after area has been cleared of brush and removed from site.

.2 Strip topsoil to depths as indicated.

.1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.3 Stockpile in locations as indicated.

.1 Stockpile height not to exceed 3 m.

.4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill.

.5 Protect stockpiles from contamination and compaction.

3.3 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than 75 mm above surface.

.3 Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to minimum depth of 150 mm.

.1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.4 SUB-GRADE APPROVAL

.1 Do not spread topsoil before approval of sub grade by Consultant. Sub-grade must be graded to the specified slope of the playing surface subgrade. The grade will extend from a line down the center of the completed field to the perimeter of the playing surface. Final grade of sub-base must be approved by Consultant.

.2 Do not begin work prior to approval of topsoil by Consultant.

3.5 SITE CONDITION

.1 Do not perform work under adverse working conditions, such as frozen ground or ground covered with snow, ice or standing water, or during rainy weather conditions without approval from Consultant.

3.6 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Non Playing Surface:

.1 Follow all directions as outlined for playing surface (see appropriate section) except depth of media is to be a minimum of 100 mm (4 inches).

.2 Playing Surface:

.1 All media must be installed to an equal depth over the entire future playing surface.

.2 Apply topsoil to result in a minimum of 150 mm (6 inches) of "settled" media in one even lift, unless otherwise indicated. As media generally settles 25 mm (1.0 inches) after applied to field, the initial layer should be 175 mm (7 inches) in thickness.

.3 Spread approved media in one uniform layer over approved sub-grade here indicated. Do not place topsoil on frozen sub-grade.

.4 Account for machinery and foot traffic when placed.

.5 Use machinery in such a way as to control (minimize) compaction of media and to achieve proposed gradients.

.6 Ensure that the media is evenly firm but not compacted.

.7 Fine grade to indicated grades and elevations , leaving surface smooth and uniform with fine loose texture.

.8 Settled media shall be flush with infield and warning track surfaces.

.3 Tree pits and Planting Beds:

.1 450 mm depth for planting beds.
.2 Depth as indicated for tree pits.
.3 Manually spread topsoil/planting soil around existing trees, shrubs and obstacles.

3.7 SOIL AMENDMENTS

.1 For turf, apply and thoroughly mix soil amendments into topsoil at rate specified and determined from sample testing.

.2 For tree pits and lawn areas: apply and thoroughly mix soil amendments into full specified depth of topsoil.

3.8 FINISH GRADING

.1 Grade surface to insure that no rough or uneven areas exist. Insure that final grade will facilitate the removal of excess water from the playing surface during future rainfall, when field is established to turf.

.2 Consolidate topsoil to required bulk density using equipment approved by Consultant. Leave surfaces smooth, uniform and firm against deep footprinting.

3.9 ACCEPTANCE

.1 Do not proceed to seeding operation before settlement and approval of finished grades by Consultant including depth, shape, and test results.

3.10 SURPLUS MATERIAL

.1 Dispose of materials except topsoil not required on site in areas directed by consultant.

3.11 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 13 - Rough Grading.
.2 Section 32 91 19.13 - Topsoil Placement and Grading.

1.2 SUBMITTALS

.1 Product Data. Submit product data in accordance with General Requirements
  .1 Provide product data for:
    .1 Seed.
    .2 Mulch.
    .3 Tackifier.
    .4 Fertilizer.
  .2 Submit in writing to Consultant 7 (seven) days prior to commencing work:
    .1 Volume capacity of hydraulic seeder in litres.
    .2 Amount of material to be used per tank based on volume.
    .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.3 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

.1 Schedule hydraulic seeding to coincide with preparation of soil surface.
.2 Schedule hydraulic seeding using grass mixtures during local growing season when moisture level is available to ensure germination and growth (April-June, September-October).

Part 2 Products

2.1 MATERIALS

.1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
  .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
    .1 Mixture composition:
      .1 40 % Kentucky Blue Grass
      .2 40% Creeping Red Fescue.

.3 20% Perennial Ryegrass

.2 Seeding rate: 245 kg/hectare.

.2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:

.1 Type I mulch:

.1 Made from wood cellulose fibre.

.2 Organic matter content: 95% plus or minus 0.5%.

.3 Value of pH: 6.0.

.4 Potential water absorption: 900%.

.2 Type II mulch:

.1 Made from newsprint, raw cotton fibre and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.

.3 Tackifier: water dilutable, liquid dispersion, water soluble vegetable carbohydrate powder.

.4 Water: free of impurities that would inhibit germination and growth.

.5 Fertilizer:

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

.2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

.1 2:4:1 80% SCU for spring and early fall planting (6-12-3)

.2 1:4:1 100% SCU for late fall planting (6-24-6)

.6 Inoculants: inoculant containers to be tagged with expiry date.

Part 3 Execution

3.1 WORKMANSHIP

.1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.

.2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Consultant.

.3 Do not perform work under adverse field conditions such as wind speeds over 10 (ten) km/h, frozen ground or ground covered with snow, ice or standing water.

.4 Protect seeded areas from trespass until plants are established.

3.2 PREPARATION OF SURFACES

.1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.

.2 Cultivated areas identified as requiring cultivation to depth of 25mm.

.3 Ensure areas to be seeded are moist to depth of 150mm before seeding.

.4 Obtain Consultant's approval of grade and topsoil depth before starting to seed.

3.3 FERTILIZING PROGRAM

.1 Fertilize prior to fine grading incorporating fertilizer equally distributed.

.2 Fertilize during establishment and warranty periods as required and as recommended by soil reports.

3.4 PREPARATION OF SLURRY

.1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Consultant. Supply equipment required for this work.

.2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.

.3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

3.5 SLURRY APPLICATION

.1 Hydraulic seeding equipment:

.1 Slurry tank.

.2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.

.3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.

.2 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.

.1 Using correct nozzle for application.

.2 Using hoses for surfaces difficult to reach and to control application.

.3 Blend application 300 mm into adjacent grass areas, sodded areas or previous applications to form uniform surfaces.

.4 Re-apply where application is not uniform.

.5 Remove slurry from items and areas not designated to be sprayed.

.6 Protect seeded areas from trespass satisfactory to Consultant.

.7 Remove protection devices as directed by Consultant.

3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of seed application until acceptance by Consultant.

.2 Grass Mixture:

.1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.

.2 Mow grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass Consultant.

.3 Fertilize seeded areas after first cutting or 10 weeks after germination provided plants have mature true leafs in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

.4 Control weeds by mechanical means utilizing acceptable integrated pest management practices.

.5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.7 ACCEPTANCE

.1 Seeded areas will be accepted by Consultant provided that:

.1 Plants are uniformly established.

.2 Seeded areas are free of rutted, eroded, bare or dead spots.

.3 Areas have been mown at least twice.

.4 Areas have been fertilized.

.2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.8 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plant material, plant material to be relocated, accessories, mulch, planting, tree supports, mulching and maintenance.

1.2 RELATED SECTIONS:

.1 Section 31 23 13 - Rough Grading.

.2 Section 32 91 19.13 - Topsoil Placement and Grading.

1.3 REFERENCES

.1 Agriculture and Agri-Food Canada (AAFC).

.1 Plant Hardiness Zones in Canada-2000.

.2 Canadian Nursery Landscape Association (CNLA).

.1 Canadian Standards for Nursery Stock- 8th Edition (2006), or latest edition.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Transportation of Dangerous Goods Act (TDGA), 1992, c.34.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

1.4 DEFINITIONS

.1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

1.5 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures

.2 Submit product data for:

.1 Fertilizer.

.2 Mycorrhiza.

.3 Anti-desiccant.

.4 Mulch.

.5 Flexible Ties

.3 Submit samples for:

.1 Mulch.

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with General Requirements

1.7 STORAGE AND PROTECTION

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Immediately store and protect plant material which will not be installed within 1 (one) hour after arrival at site in storage location approved by Consultant.

.3 Protect plant material from damage during transportation:

.1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.

.2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.

.3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.

.4 Protect stored plant material from frost, wind and sun and as follows:

.1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.

.2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots.

.3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

.5 Waste Management and Disposal:

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.3 Separate for reuse and recycling and place in designated containers Steel, Metal, and Plastic waste in accordance with WMP.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.6 Fold up metal and plastic banding, flatten and place in designated area for recycling.

.7 Divert discarded plastic plant containers materials from landfill to plastic recycling facility approved by Consultant.

.8 Dispose of unused fertilizer at official hazardous material collection site approved by Consultant.

.9 Dispose of unused anti-desiccant at official hazardous material collections site approved by Consultant.

.10 Divert unused wood and mulch materials from landfill to recycling, composting facility approved by Consultant.

1.8 SCHEDULING

.1 Obtain approval from Consultant of schedule 7 (seven) days in advance of shipment of plant material.

.2 Schedule to include:

.1 Quantity and type of plant material.

.2 Shipping dates.

.3 Arrival dates on site.

.4 Planting dates.

1.9 WARRANTY

.1 The Contractor hereby warrants that all plant material as itemized on plant list will remain free of defects for 1 (one) year, one time only providing adequate maintenance has been provided.

.2 End-of-warranty inspection will be conducted by Consultant.

.3 The Consultant reserves the right to extend Contractor's warranty responsibilities for an additional 1 (one) year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

.4 Plant material identified to be relocated shall be exempt from warranty provided proper planting procedures have been executed.

Part 2 Products

2.1 PLANT MATERIAL

.1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock 8th Edition – 2006, or latest edition.

.1 Source of plant material: grown in Zone 5a in accordance with Plant Hardiness Zones in Canada.

.2 Plant material must be planted in zone indicated as appropriate for its species.

.3 Plant material in location appropriate for its species.

.2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.

.3 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.

.4 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

2.2 WATER

.1 Free of impurities that would inhibit plant growth.

2.3 STAKES

.1 T-bar, steel, 40 x 40 x 2440 mm or wood, pointed one end, 64 x 64 x 2400 mm

2.4 FLEXIBLE TIES

~~.1~~ Trees shall be secured to stakes using ARBORTIE.

2.5 PLANTING SOIL

.1 For planting of trees and shrubs, mix stockpiled topsoil with 20% to 30% compost.

.2 Incorporate into planting soil bonemeal at a rate of 3 kg/m^3 of soil mixture.

2.6 MULCH

.1 Bark chip: varying in size from 25 (twenty-five) to 50 (fifty) mm in diameter, from bark of coniferous trees.

2.7 FERTILIZER

.1 Synthetic commercial type as recommended by soil test report.

2.8 ANTI-DESICCANT

.1 Wax-like emulsion.

2.9 FLAGGING TAPE

.1 Fluorescent, pink in colour.

2.10 SOURCE QUALITY CONTROL

.1 Obtain approval from Consultant of plant material prior to planting.

.2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial and Municipal regulations.

Part 3 Execution

3.1 PRE-PLANTING PREPARATION

.1 Ensure plant material acceptable to Consultant.

.2 Remove damaged roots and branches from plant material.

.3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.2 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 Establishment of sub grade for planting beds and tree pits as specified in Section 31 22 13 – Rough Grading.

.2 Preparation of planting beds and tree pits is specified in Section 32 91 19.13 - Topsoil Placement and Grading.

.3 For individual planting holes:

.1 Stake out location and obtain approval from Consultant prior to excavating.

.2 Excavate to depth and width as indicated.

.3 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material under direction of Consultant.

.4 Scarify sides of planting hole.

.5 Remove water which enters excavations prior to planting. Notify Consultant if water source is ground water.

3.3 PLANTING

.1 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.

.2 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.3 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.

.4 For trees and shrubs:

.1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.

.2 Form watering saucer as indicated.

.5 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.6 Water plant material thoroughly.

.7 After soil settlement has occurred, fill with soil to finish grade.

.8 Dispose of burlap, wire and container material in appropriate bins on site or under direction of Consultant.

3.4 TREE SUPPORTS

.1 Install tree supports as indicated.

.2 Use two tree supports for deciduous trees less than 3 m and three tree supports for deciduous trees 3 m and greater. Use three tree supports for all evergreens.

.1 Place stakes on prevailing wind side and 150 mm from trunk.

.2 Drive stake minimum 150 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical and unsplit.

.3 Secure to stakes using two opposing flexible ties.

.3 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.5 ACCEPTANCE

.1 Plant material will be accepted by Consultant 90 days after planting operation is completed provided that plant material exhibits healthy growing condition and is free from disease, insects and fungal organisms.

.2 Plant material installed less than 90 days prior to frost will be accepted in following spring, 30 days after start of growing season provided that acceptance conditions are fulfilled. The Landscape Architect may extend the Contractors responsibility for another growing season if bud formation is not sufficient to ensure future growth.

3.6 MULCHING

.1 Ensure soil settlement has been corrected prior to mulching.

.2 Spread mulch as indicated.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following maintenance operations from time of planting to acceptance by Consultant.

.1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.

.1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.

.2 Remove weeds monthly or as required.

.3 Replace or respread damaged, missing or disturbed mulch.

.4 For non-mulched areas, cultivate as required to keep top layer of soil friable.

.5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Consultant prior to application.

.6 Remove dead or broken branches from plant material.

.7 Keep trunk protection and guy wires in proper repair and adjustment.

.8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.8 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Consultant to end of warranty period, perform following maintenance operations.

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 Reform damaged watering saucers.

.3 Remove weeds monthly or as required.

.4 Replace or respread damaged, missing or disturbed mulch.

.5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.

.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Consultant prior to application.

.7 Apply fertilizer in early spring as indicated by soil test.

.8 Remove dead, broken or hazardous branches from plant material.

.9 Keep trunk protection and tree supports in proper repair and adjustment.

.10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.

.11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

.12 Submit monthly written reports to Consultant identifying:

- .1 Maintenance work carried out.
- .2 Development and condition of plant material.
- .3 Preventative or corrective measures required which are outside Contractor's responsibility.

END OF SECTION