Part 1 General

1.1 SECTION INCLUDES

This Section specifies the requirements for the loading, handling and disposal of contaminated soils, including Petroleum Hydrocarbon (PHC) contaminated soils.

1.2 RELATED SECTIONS

.1 Section 31 23 10 - Excavating, Trenching and Backfilling.

.2 Section 02 65 00 – Underground Storage Tank Removal.

1.3 DEFINITIONS

.1 Petroleum Hydrocarbons: Hydrocarbon products described by laboratory analyses as lubricating oil and grease, fuel oil, diesel and/or gasoline.

.2 Hydrocarbon Contaminated Soil: Soil containing concentrations of Petroleum Hydrocarbons (PHCs) in excess of CCME Commercial/Industrial Guidelines.

.3 Free Product: The presence of a layer of undiluted or non-aqueous petroleum hydrocarbon in the subsurface.

1.4 QUALIFICATIONS

.1 The Contractor shall be thoroughly familiar with and knowledgeable about existing site conditions, scope of work and requirements of the Specification.

.2 Only Contractor’s personnel capable of demonstrating a history of satisfactory experience in the area of hazardous waste management and who can satisfy Federal and Territorial requirements will be permitted to carry out the work of this Section. The Contractor’s Superintendent responsible for the work of this Section shall have a minimum of five years of experience in the area of hazardous waste management.

.3 Follow at all times, guidelines such as those established in Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities: NIOSH Publication No. 85-115, or Hazardous Waste Worker Training Manual: Canadian LIUNA - Contractors Training Council, 1992.

.4 All activities involving the handling of contaminated soils, shall be directly supervised by the Contractor’s personnel who have successfully completed a 40 hour training course for Hazardous Waste Activities in compliance with OSHA 29 CFR 1910.120 or other approved equivalent training courses such as the Canadian Hazardous Waste Workers Program.

.5 Contractor’s personnel trained as described in Clause 1.4.4 of this Section shall instruct and direct all workers with respect to the waste management procedures and labour and safety practices to be followed in carrying out the work.

.6 Provide workers, the Contract Administrator and the Contract Administrator's staff with protection appropriate to the potential type and level of exposure. Establish specific safety protocols prior to commencing clean up activities.

.7 Provide suitable safety clothing and equipment as required during the course of the work.

.8 Trained and certified personnel are required to complete all Transportation of Dangerous Goods Act (TDGA) documentation and recording requirements.

1.5 SITE CONDITIONS

.1 The Contractor shall ensure that services, not designated for demolition, are not damaged as a result of excavation work. The Contractor shall repair any services, utilities, or objects damaged by his actions at no cost to the City.

.2 Suspend operations whenever climatic conditions are unsatisfactory for excavating or regrading to conform with this Specification.

.3 After occurrence of heavy rains, do not operate equipment in designated areas until the material has dried sufficiently to prevent excessive rutting.

.4 The Contractor is advised that the ground in low-lying areas may often be saturated. Dewater saturated ground and ponded areas as required.

1.6 PROTECTION

.1 Prevent damage to benchmarks, existing buildings, surface and underground service and utility lines not designated for demolition. Immediately repair or replace any damage to the above, at no cost to the City.

1.7 PERSONNEL PROTECTION

.1 Some areas designated for cleanup under this contract may involve soils and hazardous materials which contain PCBs, inorganic elements, hydrocarbons, and other contaminants which are considered hazardous to human health.

.2 Supply sufficient quantities of designated protection equipment to fit all site personnel including the Contract Administrator and authorized visitors. Educate workers as to risks, and train in safe work practices.

.3 No separate pay item shall apply to the work practice requirements, including personnel protection, of this Section. Costs shall be included in the applicable payment items to which this Section applies.

Part 2 Execution

2.1 REMOVAL AND DISPOSAL OF CONTAMINATED SOIL

.1 Remove all surface debris prior to excavation. Remove all debris from excavated soil, sort, and dispose of appropriately.

.2 Suppress dust generated during excavation operations with a water spray. Prevent surface water from entering the excavated area.

.3 Dewater ponded contaminated soil areas, as required.

.4 Transport PHC contaminated soil to the MidCanada Waste Management Ltd. facility in Ile Des Chenes, Manitoba such that no soil (or liquid) will be spilled during transport.

.5 Clean the excavating equipment including the bucket, tracks, etc., of soil lumps and particles prior to demobilizing from the site. Take special precautions to mitigate the tracking of contaminated soil over the site area.

2.2 EQUIPMENT DECONTAMINATION

.1 Decontaminate equipment which comes into direct contact with the contaminated soils by steam cleaning or other means acceptable to the Contract Administrator in a secure area capable of containing the waste generated by the washing operation.

.2 Collect and dispose of any contaminated soil that leaks, spills or otherwise leaves the piece of equipment during transport from the area of work to the decontamination area.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section specifies requirements for:

.1 The supply and placement of fill materials.

.2 The excavation, backfilling, and grading of designated areas including site debris areas, depressions created by the removal of debris and contaminated soil, and general site areas requiring regarding and reshaping.

1.2 REFERENCES

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

.1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ;) (600 kN-m/m ;).

.5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ;) (2,700 kN-m/m ;).

.6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.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.

.3 Canadian Green Building Council (CaGBC)LEED Canada-NC Version 1.0-December 2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System For New Construction and Major Renovations.

.4 Canadian Standards Association (CSA International)

.1 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.

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

.5 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 DEFINITIONS

.1 Common excavation: excavation of materials of any nature, including soils, dense tills, hardpan, frozen materials, and partially cemented materials which can be ripped and excavated with heavy construction equipment.

.2 Regrading: the supply and placement of granular fill in designated areas to blend in with the natural terrain and provide positive drainage.

.3 Waste Material: excavated material unsuitable for use in work or surplus to requirements.

.4 Maximum Dry Density: determined by the Standard Proctor Method in accordance with ASTM D698. It is applicable if less than 30% of the material is retained on the ASTM 19 mm sieve.

.5 Corrected maximum dry density is applicable if more than 30% of the material is retained on the ASTM 19 mm sieve. It is defined as:

$$D = \frac{D1 * D2}{(F1)(D2) + (F2)(D1)}$$

Where:

D = corrected maximum dry density (kg/m^3).
F1 = fraction (decimal) of total field sample passing ASTM 19.0 mm sieve.
F2 = fraction (decimal) of total field sample retained on ASTM 19.0 mm sieve (equal to 1.0-F1)
D1 = maximum dry density (kg/m^3) of material passing ASTM 19.0 mm sieve determined in accordance with Method C of ASTM D698 or latest edition thereor.
D2 – bulk density (kg/m^3) of material retained on ASTM 19.0 mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127-84, or latest edition thereof.

.6 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.7 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.8 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Table:

Sieve Designation	% Passing
2.00 mm	100

Sieve Designation	% Passing
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

.9 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 SITE CONDITIONS

.1 Suspend operations whenever climatic conditions are unsatisfactory for grading to conform with this Specification.

.2 Do not operate equipment in work areas until the material has dried sufficiently to prevent excess rutting.

.3 Areas to be graded are to be free from debris and excessive snow, ice, or standing water.

1.5 PROTECTION

.1 Prior to commencing any excavation work, notify Contract Administrator, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.2 Prevent damage to benchmarks, existing buildings, surface or underground service or utility lines which are to remain. Immediately repair any damage to the above or replace the above in the event of damage, at no cost to the Owner.

1.6 TESTING

.1 Contractor will appoint the services of a testing laboratory and pay for the services under his contract unless otherwise stipulated.

Part 2 Products

2.1 MATERIALS

.1 Type 1 and Type 2 fill: properties to the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 and/or CAN/CGSB-8.2.

.3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-

Sieve Designation	% Passing	
	Type 1	Type 2
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

.2 Type 3 fill: selected material from excavation or other sources, approved by the Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated, if applicable.

3.2 PREPARATION/PROTECTION

.1 Keep excavations clean, free of standing water, and loose soil.

.2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Engineer's approval.

.3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.

3.3 STOCKPILING

.1 Stockpile fill materials in areas designated by the Engineer.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.4 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as directed by the Contract Administrator.

.2 Remove concrete, masonry, rubble, and other obstructions encountered during excavation in accordance with Section X – Debris Removal.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by the Contract Administrator.

.6 Restrict vehicle operations directly adjacent to open trenches.

.7 Dispose of contaminated soil in accordance with Section 02066 – Contaminated Soils.

.8 Do not obstruct flow of surface drainage or natural watercourses.

.9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.10 Notify Contract Administrator when bottom of excavation is reached.

.11 Obtain Contract Administrator approval of completed excavation.

3.5 BACKFILLING

.1 For backfilling operations, use compaction equipment capable of obtaining required densities in materials on project.

.2 Do not proceed with backfilling operations until Engineer has inspected and approved excavation.

.3 Areas to be backfilled are to be free from debris, snow, ice and water.

.4 Commence backfilling of excavated soil areas within 3 days of receipt of confirmatory sampling results indicating no further excavation in the area is required. Costs for any extra work caused as a result of leaving excavations open longer will be the responsibility of the Contractor.

.5 Place specified backfill material in uniform horizontal layers in depths as indicated in this Section up to grades indicated. Layers should be laid in 0.6 m lifts and compacted to 95% Standard Proctor Density. The top layer is to be compacted to 98%.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.5 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.6 Verify field measurements and affected adjacent Work are co-ordinated.

.7 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator review of submittals.

.8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator.

.9 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in The Province of Manitoba, Canada. Where noted in the Technical Specifications.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.1 Prior to construction, the contractor shall submit a schedule of shop drawing submittals and anticipated equipment deliveries.

.4 Allow 14 days for Contract Administrator review of each submission.

.5 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.

.6 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, in duplicate containing:

.1 Date.
.2 Project title and number.
.3 Contractor's name and address.
.4 Identification and quantity of each shop drawing, product data and sample.
.5 Other pertinent data.

.8 Submissions include:

.1 Date and revision dates.
.2 Project title and number.
.3 Name and address of:
.1 Subcontractor.
.2 Supplier.
.3 Manufacturer.
.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
.5 Details of appropriate portions of Work as applicable:
.1 Fabrication.
.2 Layout, showing dimensions, including identified field dimensions, and clearances.
.3 Setting or erection details.
.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to adjacent work.

.9 After Contract Administrator’s review, distribute copies.

.10 Submit 6 prints of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

.11 Submit 6 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit 6 copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit 6 copies of certificates for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit 6 copies of manufacturers instructions for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit 6 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit 6 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.

.17 Delete information not applicable to project.

.18 Supplement standard information to provide details applicable to project.

.19 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.20 The review of shop drawings by the Contract Administrator is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Contract Administrator approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of

responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Contract Administrator;s business address.

.3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.

.6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

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 SUBMITTALS

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

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Revise content of documents as required prior to final submittal.

.4 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, four final copies of operating and maintenance manuals in English.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 Furnish evidence, if requested, for type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.2 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dxf dwg format on CD.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;Date of submission; names.

.1 Addresses, and telephone numbers of Contract Administrator and Contractor, Design-Builder with name of responsible parties.

.2 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Contract Administrator one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.Field test records.

.6 Inspection certificates.

.7 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Contract Administrator.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Contract Administrator.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.4 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.5 Provide servicing and lubrication schedule, and list of lubricants required.

.6 Include manufacturer's printed operation and maintenance instructions.

.7 Include sequence of operation by controls manufacturer.

.8 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.9 Provide installed control diagrams by controls manufacturer.

.10 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.11 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.12 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.13 Include test and balancing reports.

.14 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site, place and store.

.4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.9 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site; place and store. Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.

1.12 OPERATING AND MAINTENANCE MANUALS

.1 For the guidance of the City’s operating and maintenance personnel, the Contractor shall prepare O&M Manuals for the Work, describing in detail the construction of each part of the Work and the recommended procedure for operation, servicing and maintenance.

.2 Three (3) advance copies of the manuals shall be submitted two months prior to Substantial Performance of the Work for review and comments. A maximum of eight weeks after review, six (6) copies of the final manuals shall be submitted. Each copy shall be clearly titled to show all of the information required by the Specifications as well as operational information including: the item of Work concerned, a City’s Contract number, the name and address of the Contractor, the issue date, operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules.

.3 All instruction in these manuals shall be in simple language to guide the City in the proper operating and maintenance of this installation.

.4 In addition to hard copies specified above, submit one (1) O&M Manual in electronic format (MS Word for text; Acrobat PDF for graphics). Organize contents into applicable sections of Work, parallel to Specifications Break-down.

.5 In addition to information called for in the Specification, include the following:

.1 Title sheet, labels “Operation and Maintenance Instructions”, and containing project name and date.

.2 List of contents:

.1 Brochures/catalogue excerpts of all architectural, structural, mechanical and electrical components of the Work.

.2 Documentation of all test results.

.3 Complete set of equipment and assembly drawings.

.4 Installation, start-up, O&M Manuals

.5 Commissioning data sheets and reports

.6 Air balancing reports

.7 Spare parts lists and prices, and special tools requirements and prices

.8 Any specific product or maintenance manual requirements from the Specification.

.3 Reviewed Shop Drawings of all equipment.

.4 As-Constructed Drawings of all civil, structural, process equipment, mechanical, electrical, instrumentation and controls installations.

.5 Full description of entire mechanical system and operation.

.6 Names, addresses, and telephone numbers of all major sub-contractors and suppliers.

.7 Detailed operations and maintenance instructions for all items of equipment, including a preventative maintenance program.

.6 The Contractor shall modify and supplement the manual as required by the Contract Administrator.

.7 Provide list of spare parts and consumables, including name and address of nearest supplier.

.8 The O&M Manuals shall be supplied to the City before equipment delivery and provision shall be made for additions and deletions, which may be dictated by the City’s operational experience. Where these amendments to the manuals are indicated to be necessary during initial operation before acceptance, the Contractor shall supply the amended Sections free of charge.

.9 Payment for this item of the Work, as listed in Form B: Prices, will not be issued until all requirements for the O&M Manuals have been satisfied.

1.13 AS-CONSTRUCTED DRAWINGS

.1 After award of Contract, the Contract Administrator will provide a complete set of Drawings for the purpose of maintaining Project As-Constructed Drawings. Electronic files in AutoCAD format will be supplied. Accurately record significant deviations from Contract Documents caused by Site conditions and changes ordered by the Contract Administrator. Update daily.

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 DESCRIPTION

.1 This Section contains requirements for training the City staff, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this Contract.

.2 Training sessions are required during the equipment testing.

.3 The intent is that the City should receive sufficient training on the equipment and systems that they are going to operate and maintain. The Contract Administrator shall have the authority to determine the duration and content of each training session required.

1.2 SUBMITTALS

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

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates. Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.3 Give time and date of each demonstration, with list of persons present.

1.3 LOCATION

.1 Where specified, conduct training sessions for the City staff, operations and maintenance personnel, on the operation, care and maintenance of the equipment systems installed under this Contract. Training will take place at the Site of the Work and under the conditions specified in the following paragraphs.

.2 Field training sessions will take place at the Site of the equipment.

1.4 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

1.5 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled agreed upon times, at the equipment designated location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.6 TIME ALLOCATED FOR INSTRUCTIONS

.1 The Contractor shall provide a minimum of 12 hours of on-site instruction to the City Maintenance personnel.

.1 The instructions shall be given over a minimum of two days.

.2 The Contract Administrator shall be present at the instruction sessions.

.2 The Contractor shall utilize Manufactor's Representatives for the following systems and equipment.

.1 The natural gas generator.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 GENERAL REQUIREMENTS

.1 Conduct training in conjunction with the equipment testing period. Schedule classes such that classroom sessions are interspersed with field instruction in logical sequence. Arrange to have the training conducted on consecutive days.

.2 Provide final O & M Manuals, as defined in Section 013330 - Submittal Procedures, for the specific equipment to the City at four weeks prior to the start of any training.

3.2 OPERATOR HANDS-ON TRAINING

.1 As Minimum, hands-on equipment training for operations personnel will include:

.1 Identifying instrumentation: location of primary element; location of instrument readout; discuss purpose, basic operation, and information interpretation.

.2 Discussing, demonstrating and performing standard operating procedures and daily visual inspection of system operation.

.3 Discussing and performing the preventative maintenance activities.

.4 Discussing and performing start-up and shutdown procedures.

.5 Performing the required exercise procedures.

.6 Performing routine disassembly and assembly of equipment if applicable.

.7 Identifying and reviewing safety items and performing safety procedures, if feasible.

3.3 MAINTENANCE HANDS-ON TRAINING

.1 Hands-on equipment training for maintenance and repair personnel will include:

.1 Locating and identifying equipment components.

.2 Reviewing the equipment function and theory of operation.

.3 Reviewing normal repair procedures.

.4 Performing routine start-up and shutdown procedures.

.5 Reviewing and performing the safety procedures.

.6 Performing City - approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and trouble shooting equipment.

.7 Reviewing and using Contractor's manuals in the hands-on training.

3.4 TRAINING COMPLETION FORMS AND PAYMENT

.1 Training for the Contractor - supplied equipment shall be conducted prior to commissioning.

.2 The Contract shall not be considered complete, for the purpose of issuing a Certificate of Substantial Performance, until the training has been provided.

.3 Form T1: to be completed for initial training. One (1) form to be used for each item of equipment or system for which training has been provided.

.4 Form T2: to be completed for training during the warranty period. One (1) form is to be used for each equipment/ system for which has been provided.

.5 Payment for this work will be released only when the training has been completed to the City's satisfaction and the respective forms signed.

.6 A sample of Forms T1 and T2are attached to this Specification Section.

CERTIFICATE OF SATISFACTORY TRAINING
FORM T1

We certify that the initial training for the equipment listed below has been provided as per the Specifications.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO. _____

_____ _____

(Trainer) Date

_____ _____

(Authorized Signing Representative of the City) Date

CERTIFICATE OF SATISFACTORY TRAINING
FORM T2

We certify that the final training for the equipment listed below has been provided as per the Specifications.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO. _____

_____ _____
(Trainer) Date

_____ _____
(Authorized Signing Representative of the City) Date

Part 1 General

1.1 GENERAL

.1 At the time of the commissioning, the Contract Administrator shall advise the Contractor of the commissioning requirements. These requirements are dependent on the anticipated operational requirements of the Perimeter Road Pumping station at the time.

.2 The Contractor shall refer to all Divisions for details on the commissioning procedures not included in this Section.

.3 The Contractor shall note that on materials and equipment installed in this Contract, warranty will not begin until issuance of Total Performance.

1.2 INTENT

.1 This Section describes the Contractor's responsibilities in the commissioning and handover of the process, electrical, HVAC and other systems to be installed as part of this Work.

1.3 DEFINITIONS

.1 System: for the purpose of this Specification Section, a system shall be defined as the equipment, piping, controls, ancillary devices, electrical power, etc., which together perform a specific function at the facility.

.2 Commissioning: for the purpose of this Specification Section, commissioning shall be defined as the successful operation of a system in accordance with its design requirements for a period of 28 days, the last seven of which shall be consecutive, unless otherwise specified.

.3 Acceptance: for the purpose of this Specification Section, acceptance shall be defined as the formal turnover of a system to the City for his operation and maintenance. This shall occur after the successful end of commissioning of each system through a formal agreement between the Contract Administrator, the City, and the Contractor. Success of the commissioning period is determined by the Contract Administrator.

1.4 COMMISSIONING TEAM

.1 The Work of commissioning will be conducted by the Contractor, the City, and the Contract Administrator.

.2 The City's appointed staff shall represent process personnel and operating staff.

.3 The Contractor shall provide personnel representing the appropriate trades, including I&C personnel during the commissioning. These personnel shall be skilled workmen, able to expedite any minor repairs, adjustments, etc., as are required to complete commissioning with as few delays as possible.

1.5 COMMISSIONING PLAN

.1 Develop a detailed methodology for the commissioning of each system at least 45 calendar days prior to planned start of commissioning. The plan shall be drafted by the Contractor and Contract Administrator and include the following:

- .1 Detailed schedule of events, including but not limited to the schedule for completion of testing of all component parts of the system prior to commissioning of a system.
- .2 Tests necessary to verify compliance with performance specifications.
- .3 Planned attendance schedule for manufacturer's representatives.
- .4 Drawings and sketches as required to illustrate the planned sequence of events.
- .5 List and details for all temporary equipment (pumps, etc.) required to facilitate Commissioning.
- .6 List of all personnel who the Contractor plans for commissioning and handover with information indicating their qualifications for this Work.

.2 The commissioning plan shall be reviewed prior to its implementation. The Contract Administrator shall be the final arbiter.

1.6 EQUIPMENT

.1 All process, mechanical, electrical, control, and miscellaneous equipment related to a system shall be successfully installed and tested in accordance with specific requirements noted in other Divisions.

.2 As required in Section 01 78 00 – Closeout Submittals, O&M Manuals will be submitted and reviewed by the Contract Administrator.

.3 Staff training sessions shall be completed.

.4 Temporary equipment will be installed and tested as necessary to ensure that it function reliably and consistently through the commissioning period.

1.7 CONTROLS

.1 All controls which are the responsibility of this Contractor shall be installed and tested prior to commissioning.

.2 The Contract Administrator shall arrange for the simulation of the control sequences or shall allow for the operation of the system without the features included in the Work of others. Every effort shall be made to ensure that the commissioning period provides for the full and comprehensive operation of the equipment under all anticipated normal and adverse operating conditions.

1.8 MANPOWER

.1 Supply all staff required during commissioning as necessary to assist the City's staff in the operation of the plant.

.2 Supply competent staff capable of maintaining, repairing, and adjusting the equipment and controls to achieve the intended design functions during the commissioning period.

.3 Ensure equipment manufacturer's representatives are available as necessary to certify adjustments in equipment, to guide in setting correct operating limits, and to generally provide input as required for the appropriate operation of the equipment.

1.9 OPERATING DESCRIPTIONS

.1 Operating descriptions shall be prepared by the Contract Administrator for the plant systems. Other information outlining the operating requirements shall also be available from the Contract Administrator. The Contractor will review these descriptions and will make himself familiar with the requirements in order that he can undertake commissioning in an appropriate manner.

1.10 DESIGN PARAMETERS

.1 Design parameters for the systems to be commissioned shall be as defined in the Specifications and/or the operating descriptions. The commissioning team will identify to the Contractor, which parameters shall be modified prior to commissioning and shall be responsible for any subsequent changes during the commissioning period.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PREPARATIO

.1 Each items of equipment included in the system to be commissioning shall be satisfactorily tested and operated for a period of three (3) consecutive days.

.2 Piping, wiring, and other conduit systems shall be finished and tested.

.3 Electrical connections shall be completed and inspected to the satisfaction of the governing authorities.

.4 All other regulatory inspections shall be completed to the satisfaction of the governing authorities.

.5 Control systems shall be completed and related control software debugged.

3.2 SEQUENCE

.1 For each system, the following sequence of events shall be followed:

.1 O&M Manuals shall be available at least 14 days prior to the start of commissioning.

.2 The Contract Administrator will make operating descriptions available prior to testing. Draft operating descriptions are included in this Contract.

.3 Initial operator training shall be undertaken two weeks prior to commissioning.

.4 Equipment performance tests shall be conducted successfully.

.5 Start and run system in manual mode.

.6 Turn separate items of equipment to automatic in a planned and logical manner. Ensure that the control system is operating the equipment in a manner which precludes damage of the equipment and which is consistent with the process operating requirements.

.7 Commence commissioning period of 28 days. The equipment shall operate continuously and successfully through the last seven days of a commissioning period. Minor failures shall not void the commissioning period. A minor failure is defined as one which does not present a safety hazard, does not impact overall process functioning and can be temporarily overcome by the use of available standby equipment. The last seven days of the commissioning period shall be re-started if a critical failure occurs. A critical failure shall be deemed as one, which prohibits the process from functioning successfully for an eight hour period or one, which creates a safety hazard.

.8 Upon completing the commissioning period, the system shall be granted formal acceptance by the Contract Administrator.

3.3 ACCEPTANCE

.1 The commissioning of a system shall be considered acceptable when the equipment has operated in a stable manner, satisfying the design criteria for a period of 28 days, the last seven of which shall be continuous and consecutive, unless otherwise specified.

.2 When a system has been commissioned satisfactorily, the system shall be formally accepted for operating and routine maintenance by the City's forces. On successful completion of Commissioning Form 104 – Certificate of Satisfactory Process Performance attached to this Specification will be signed by the representative of the manufacturer, Contractor, Contract Administrator, and the City.

.3 An acceptance meeting must be held at the end of the 28 day test to confirm the status of each system.

.4 Notice of Acceptance of for the entire project will be granted when all systems have been commissioned and accepted, and all requirements of the General Conditions have been completed.

CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE
FORM 104

We certify that the equipment listed below has been operated and tested as per the Specification using water and that the equipment meets its performance testing criteria. The equipment is therefore classed as "conforming".

Project: _____

System Description: _____

_____

Tag No(s): _____

Reference Specification (s): _____

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

_____ _____
(Authorized Signing Representative of the Contractor) Date

_____ _____
(Authorized Signing Representative of the Contract Administrator) Date

_____ _____
(Authorized Signing Representative of the City of Winnipeg) Date

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 An abridged version of methods and procedures for demolition of structures, parts of structures, basements and foundation walls, including abandonment and removal of septic tanks and tanks containing petroleum products.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA S350-M1980(R1998), Code of Practice for Safety in Demolition of Structures.

1.4 SUBMITTALS

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

.2 Before proceeding with demolition of load bearing walls or of other walls and where required by authority having jurisdiction submit for review by Contract Administrator shoring and underpinning drawings prepared by qualified professional engineer registered or licensed in the Province of Manitoba in Canada showing proposed method.

1.5 SITE CONDITIONS

.1 Review designated substance report and take precautions to protect environment.

.2 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Contract Administrator immediately.

.1 Do not proceed until written instructions have been received from Contract Administrator.

.3 Notify Contract Administrator before disrupting building access or services.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 PROTECTION

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

3.2 DEMOLITION SALVAGE AND DISPOSAL

.1 Remove parts of existing building to permit new construction. Sort materials into appropriate piles for reuse and recycling .

.2 Refer to drawings and specifications for items to be salvaged for reuse.

.3 Remove items to be reused, store as directed by Contract Administrator and re-install under appropriate section of specification.

.4 Trim edges of partially demolished building elements to tolerances as defined by Contract Administrator.

.5 Dispose of removed materials, to appropriate recycling facilities reuse facilities except where specified otherwise, in accordance with authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Export and Import of Hazardous Waste Regulations SOR/2002-300.

.2 National Fire Code of Canada 2005.

.3 Transportation of Dangerous Goods Act (TDG Act) 1999, (c. 34).

.4 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

1.2 DEFINITIONS

.1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.4 Workplace Hazardous Materials Information System (WHMIS): a Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 013300 - Submittal Procedures.

.2 Submit to Contract Administrator current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Contract Administrator that identifies hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.4 STORAGE AND HANDLING

.1 Co-ordinate storage of hazardous materials with Contract Administrator and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45litres for work purposes requires the written approval of the Contract Administrator.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.

.7 Do not use flammable liquids having flash point below 38 degrees C, such as naptha or gasoline as solvents or cleaning agents.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are not mixed.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.Report spills or accidents immediately to Contract Administrator. Submit a written spill report to Contract Administrator within 24 hours of incident.

1.5 TRANSPORTATION

.1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.

.3 If hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with Contract Administrator.

.2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.

.3 Use licensed carrier authorized by provincial authorities to accept subject material.

.4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.

.5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

.6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.

.7 Provide photocopy of shipping documents and waste manifests to Contract Administrator.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Contract Administrator.

.9 Report discharge, emission, or escape of hazardous materials immediately to Contract Administrator and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

.1 Only bring on site quantity of hazardous materials required to perform work.

.2 Maintain MSDSs in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.
.2 Hazardous waste burned for energy recovery.
.3 Lead-acid battery recycling.
.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and procedures for the removal of underground storage tanks.

1.2 RELATED SECTIONS

.1 Section 02066 – Contaminated Soils.

.2 Section 02209 - Excavating, Trenching and Backfilling.

1.3 REFERENCES

.1 Canadian Council of Ministers of the Environment (CCME).

.1 CCME PN1326-2003, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products.

.2 CCME PN1299-1999, Canadian Environmental Quality Guidelines.

.1 Chapter 7-Updated 2007, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

.2 Canadian Federal Legislation

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.1 Section 53 Technical CEPA Guidelines for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products 1995.

.2 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.

.3 Canada Labour Code (R.S. 1985, c. L-2).

.1 Part II (Updated June 2006) - Occupational Health and Safety.

.4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.3 Underwriters' Laboratories of Canada (ULC).

.1 ULC-S603-2000, Underground Steel Tanks.

.2 ULC-S615-1998, Underground Reinforced Plastic Tanks.

1.4 SUBMITTALS

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

.2 Provide written description of tank, its former contents, location and reason for removal.

.3 Provide the Contract Administrator and Regulator (Manitoba Conservation) with copy of vapour removal test results.

□

.4 Forward affidavit of destruction of underground storage tanks to the Contract Administrator and Regulator.

1.5 QUALITY ASSURANCE

.1 Contractor must be licensed/certified by Manitoba Conservation for removal of underground storage tanks.

.1 License/certificate, title and number must accompany the bid submission.

.2 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA and applicable Provincial regulations.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Segregate and deliver non-salvageable or non-recyclable materials, including waste liquids and sludges to a Provincially licensed waste facility.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PREPARATION SAFETY AND SECURITY

.1 Conform to or exceed Federal, Provincial and Territorial codes, local municipal by-laws, by-laws, and codes and regulations of utility authorities having jurisdiction.

.2 Comply with occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

.3 Protection.

.1 Meet safety requirements of Occupational Safety and Health, Canada Labour Code Part II and Regulations for Construction Projects.

.2 Disconnect or remove source of ignition from vicinity of tank.

.3 Provide temporary protection for safe movement of personnel and vehicle traffic.

.4 Cut, braze or weld metal only in monitored areas established to be free of ignitable vapour concentrations.

.5 Ground and bond metal equipment, including tanks and transfer pipes, before operating equipment or transferring flammable materials.

.6 Use non-sparking tools and intrinsically safe electrical equipment.

.7 On-site smoking is not permitted at any time.

3.2 DRAINING

.1 Drain and flush piping into tank.

□

.2 Pump out liquid from tank

.1 Use explosion proof, air driven or hand pump.

.3 Remove sludge from tank bottom.

.1 Dispose of product and sludge in accordance with local, and Provincial regulations using waste disposal carrier licensed by Manitoba Conservation.

3.3 EXCAVATION TRENCHING AND BACKFILL

.1 Do work in accordance with Section 31 23 10 - Excavation, Trenching and Backfilling.

.2 Provide protective material around excavation.

.3 Provide constant supervision during excavation and backfilling.

.4 Excavation.

.1 Excavate until top of tank and connections and openings are exposed. The Contractor shall contact the Contract Administrator for an inspection immediately after the tank is exposed.

.2 Disconnect piping.

.1 Remove fill tube.

.2 Disconnect fill gauge, product and vent lines.

.3 Cap or plug open ends of lines that are not to be used further.

.4 Remove piping from ground.

.3 Temporarily plug tank openings.

.4 Continue excavation until tank is completely exposed.

.5 Temporarily stockpile on site soil in vicinity of tank, until waste classification can be established by the Contract Administrator prior to final disposal.

3.4 TANK REMOVAL

.1 Remove tank in accordance with CCME Code of Practice PN1326 and place in secure location.

.2 Block tank to prevent movement.

.3 Contact Contract Administrator immediately if there is evidence of contamination in tank excavation, stop Work until further notice.

.4 Remove and replace contaminated soil and accumulated flammable or combustible liquid with clean fill common to local area in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling and Section 02066 – Contaminated Soils.

3.5 VAPOUR REMOVAL

.1 Purging:

.1 Purge vapours to less than 10% of lower explosive limit (LEL).

.2 Verify with combustible gas metre.

□

.2 Inverting:

.1 Displace oxygen to levels below necessary to sustain combustion.

.2 Verify with combustible gas metre.

.3 Water Method:

.1 Fill tank with water to expel vapours.

.2 Remove and dispose of contaminated water in accordance with regulations after tank is removed from site.

.3 Verify with combustible gas metre.

.4 Dry Ice Method:

.1 Add 1.85 gm of solid carbon dioxide (dry ice) for each 100 litre capacity.

.2 Crush and distribute ice evenly over greatest area to secure rapid evaporation. Avoid skin contact.

.3 Verify dry ice has vapourized.

.5 Air Method:

.1 Ventilate tank with air using small gas exhauster operated with compressed air.

.2 Air to enter opening at one end and to exit opening at other end to quickly remove vapour.

.3 Test interior of tank to determine when tank is free of vapour.

3.6 CAPPING

.1 Plug or cap holes after tank has been freed of vapours and before tank is moved from site.

.1 Leave vents open.

.2 Plug corrosion leak holes using screwed (boiler) plugs.

.3 Leave a 3 mm vent hole in one plug to prevent tank from being subjected to excessive pressure differential caused by extreme temperature change.

3.7 SECURING AND REMOVAL FROM SITE

.1 Check vapour levels prior to transport.

.1 Remove vapour if required.

.2 Dispose of tank in accordance with local, Provincial, and Federal regulations.

.3 Truck removal.

.1 Secure tank on truck for transport to disposal site.

.2 Cut suitable openings in tank sides to render tank unusable.

.3 Ensure 3 mm vent hole located at uppermost point on tank.

3.8 SITE REMEDIATION

.1 To CCME-PN 1299 and according to Section 02066 – Contaminated Soils.

□

.2 Repair/replace finish grade to match surrounding area.

3.9 WORKMANSHIP AND DISPOSAL

.1 Tanks destined for disposal.

.1 Dismantle, cut sufficient openings or otherwise render unusable.

.2 Tanks for reuse.

.1 Refurbish to: ULC-S603 and ULC-S615.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Removal as specified of spray or trowel-applied asbestos-containing material located as indicated except where removal is considered impracticable by Contract Administrator.

.2 Removal (other than defined minor amounts) of friable materials containing asbestos.

.3 Removal of amosite or crocidolite asbestos-containing materials.

.4 Use of power tools that are fitted with dust collectors equipped with HEPA filter to cut, shape, grind, drill, scrape, or abrade manufactured products containing asbestos.

1.2 RELATED SECTIONS

.1 City of Winnipeg CW 1110 – General Instructions.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.205-94, Sealer for Application to Asbestos-Fibre-Releasing Materials.

.2 Canadian Standards Association (CSA International).

.3 Department of Justice Canada.

.1 Canadian Environmental Protection Act (CEPA), 1999.

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

.1 Material Safety Data Sheets (MSDS).

.5 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.6 Underwriters' Laboratories of Canada (ULC).

.7 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH).

.1 NIOSH 94-113-August 1994, NIOSH Manual of Analytical Methods (NMAM), 4th Edition.

.8 U.S. Department of Labour - Occupational Safety and Health Administration - Toxic and Hazardous Substances.

.1 29 CFR 1910.1001-2001, Asbestos Regulations.

1.4 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.3 Asbestos-Containing Materials (ACMs): materials identified under Existing Conditions Article, including fallen materials and settled dust.

.4 Asbestos Work Area: Area where actual removal and sealing and enclosure of spray or trowel-applied asbestos-containing materials takes place.

.5 Authorized Visitors: Contract Administrator, or designated representatives, and representatives of regulatory agencies.

.6 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.7 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.8 Polyethylene sheeting sealed with tape: Polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.

.9 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm polyvinyl-chloride bag.

.2 Integral 0.25 mm thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible double-pull double throw zipper on top.

.4 Straps for sealing ends around pipe.

.5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.

.10 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) HEPA-filter leak test.

.11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.12 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.

.1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.

.13 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.

.14 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.

1.5 SUBMITTALS

.1 Before beginning work:

.1 Obtain from appropriate agency and submit to Contract Administrator necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material being dumped, and proper methods of disposal. Submit proof satisfactory to Contract Administrator that suitable arrangements have been made to receive and properly dispose of asbestos waste.

.2 Submit proof satisfactory to Contract Administrator that employees have had instruction on hazards of asbestos exposure, respirator use, dress, use of showers, entry and exit from work areas, and aspects of work procedures and protective measures. Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Contract Administrator. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.

.3 Submit layout of proposed enclosures and decontamination facilities to Contract Administrator for review.

.4 Submit documentation including test results for sealer proposed for use.

.5 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.6 Submit proof of Contractor's Asbestos Liability Insurance.

.7 Submit proof satisfactory to Contract Administrator that employees have respirator fitting and testing. Workers must be fit-tested (irritant smoke test) with respirator that is personally issued.

.8 Submit Worker's Compensation Board status and transcription of insurance.

.9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:

.1 encapsulants;

.2 amended water;

.3 slow-drying sealer.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:

.1 Respirator equipped with HEPA filter cartridges or supplied-air type, personally issued to worker and marked as to efficiency and purpose, and acceptable to Authority having jurisdiction as suitable for type of asbestos and level of asbestos exposure in Asbestos Work Area. If disposable type filters are used, provide sufficient filters so that workers can install new filters following disposal of used filters and before re-entering contaminated areas.

.2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full-body covering including head covering with snug-fitting cuffs at wrists, ankles, and neck.

.2 Requirements for each worker:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated worksuits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.

.4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter work area.

.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.

.5 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.7 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 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 the CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.8 SCHEDULING

.1 Not later than ten (10) days before beginning Work on this Project notify following in writing:

.1 Provincial/Territorial, Department of Labour.

.2 Disposal Authority.

.2 Inform sub-trades of presence of friable asbestos-containing materials identified in Existing Conditions.

.3 Submit to Contract Administrator copy of notifications prior to start of Work.

1.9 OWNER'S INSTRUCTIONS

.1 Before beginning Work, provide to Contract Administrator satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Proper fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

Part 2 Products

2.1 MATERIALS

.1 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: minimum 0.15 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

.4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by Contract Administrator, mixed with water in concentration to provide adequate penetration and wetting of asbestos-containing material.

.5 Asbestos waste containers: Metal or fibre - type acceptable to dump operator with tightly fitting covers and 0.15 mm minimum thickness sealable polyethylene liners.

.1 Label containers in accordance with Asbestos Regulations 29 CFR 1910.1001. Label in both official languages.

.6 Encapsulants : Type 2 surface film forming, Type 1 penetrating, type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada having following characteristics:

.7 Glove bag: acceptable materials include safe-T-strip products in configuration suitable for Work, or alternative material approved in accordance with B6.

.1 Equip glove bags intended for use in more than one location with reversible, double-pull, double-throw zipper on top and at approximately mid-section of bag.

.8 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.1 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.

Part 3 Execution

3.1 PREPARATION

.1 Work Areas:

.1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Conduct smoke tests to ensure that duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.

.2 Clean proposed work areas using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.

.3 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument.

.4 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.5 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use one layers of FR polyethylene on floors. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.

.6 Build airlocks at entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.

.7 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used : "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".

.8 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Contract Administrator. Use localized water spraying during fixture removal to reduce fibre dispersal.

.9 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.10 Where application of water is required for wetting asbestos-containing materials, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with

applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.2 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:

.1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work areas, with two curtained doorways, one to Shower Room and one to work areas. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work areas. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.

.2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Cold water source is available from internal storage tank (capacity to be confirmed as adequate by Contractor). Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Contract Administrator before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.

.3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.3 Container and Equipment Decontamination Enclosure System:

.1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.

.1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.

.2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.

.3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.

.4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.

.4 Construction of Decontamination Enclosures:

.1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use one layers of FR polyethylene on floors.

.2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas:

.1 Separate parts of building required to remain in use from parts of building used for asbestos abatement by means of airtight barrier system constructed as follows:

.1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create airtight barrier.

.2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in tidy condition.

.2 Ensure that barriers and polyethyene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

.3 Visually inspect enclosures at beginning of each working period.

.4 Use smoke methods to test effectiveness of barriers when directed by Contract Administrator.

.7 Do not begin Asbestos Abatement work until:

.1 Arrangements have been made for disposal of waste.

.2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.

.3 Work areas and decontamination enclosures and parts of building required to remain in use are effectively segregated.

.4 Tools, equipment, and materials waste containers are on hand.

.5 Arrangements have been made for building security.

.6 Warning signs are displayed where access to contaminated areas is possible.

.7 Notifications have been completed and other preparatory steps have been taken.

3.2 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.3 ASBESTOS REMOVAL

.1 Before removing asbestos:

.1 Prepare site.

.2 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.

.2 Remove saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brushed and wet-sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.

.5 Where Contract Administrator decides complete removal of asbestos-containing material is impossible due to obstructions such as structural members or major service elements, or because asbestos-containing material was originally applied to asphaltic coating, and provides written direction, encapsulate material as follows:

.1 Apply surface film forming type sealer to provide 0.635 mm minimum dry film thickness over sprayed asbestos surfaces. Apply using airless spray equipment to avoid blowing off fibres. Use different colour for each coat. Use colour for final coat.

.6 After wire brushing and wet sponging to remove visible asbestos, and after encapsulating asbestos-containing material impossible to remove, wet clean entire work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted.

3.4 ASBESTOS ENCAPSULATION

.1 Before encapsulating asbestos:

.1 Prepare site.

.2 Vacuum surfaces in work areas except those to be sealed, using HEPA vacuum to remove loose debris and dust particles.

.3 Repair damaged and missing areas of existing sprayed asbestos to obtain suitable base for sealing and to restore continuity of fireproofing. Use specified asbestos-free fireproofing material. Prepare surfaces and apply fireproofing in accordance with manufacturer's printed instructions.

.4 Remove loose asbestos and pack in sealable plastic bags 0.15 mm minimum thick and place in labelled waste containers for transport.

.5 Seal filled waste containers. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination washroom. Wash waste containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that waste containers are removed from holding areas by workers who have entered from uncontaminated areas dressed in clean coveralls.

.2 Apply surface film forming type sealer to provide 0.635 mm minimum dry film thickness over sprayed asbestos surfaces. Apply using airless spray equipment to avoid blowing off fibres. Use different colour for each coat.

.3 After sealing asbestos surfaces wet clean the entire work area including Equipment and Access Room, and equipment used in the process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning.

.4 Install warning signs in both official languages in 25 mm sans serif letters worded as follows: WARNING - SEALED ASBESTOS/ATTENTION AMIANTE ENCAPSULÉ.

3.5 PIPE INSULATION REMOVAL USING GLOVE BAG

.1 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.

.2 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.

.3 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.

.4 When glove bags are intended for use at more than one location: after wash-down and application of sealer, seal off waste in lower section of bag using zipper at mid-section of bag. Remove air from top section of bag through elasticized valve using HEPA vacuum. Remove bag from pipe, reinstall in new location, and reseal to pipe prior to opening lower section of bag. Repeat stripping operation.

.5 If bag is to be moved along pipe, first remove air from top section through elasticized valve using HEPA vacuum. Next loosen straps, move bag, re-seal to pipe using double-pull zipper to pass hangers. Repeat stripping operation.

.6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.

.7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow-drying sealer to seal in any residual fibres.

.8 Upon completion of work shift, cover exposed ends of remaining pipe insulation with polyethelene taped in place.

3.6 FINAL CLEANUP

.1 Following cleaning and when air sampling shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by membrane filter method at 400-500X magnification phase contrast illumination, as described in NIOSH 94-113 or equivalent, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos-containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.

.5 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air-monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.

.7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 When cleanup is complete:

.1 Re-secure mounted objects removed in course of Work in their former positions.

.2 Re-establish mechanical and electrical systems in proper working order. Install new filters.

.3 Repair or replace objects damaged in the course of Work, as directed by Contract Administrator.

3.8 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Contract Administrator to take air samples on daily basis outside of work area enclosure in accordance with Health Canada recommendations.

.1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

.2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.

.1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.

.2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to work areas.

.3 During course of Work, Contract Administrator to measure fibre content of air outside work areas by means of fibrous aerosol monitors (FAM).

.1 When FAM readings exceed 0.25 f/cc adopt more stringent work procedures immediately and carry out PCM test.

.2 Stop Work when PCM measurements exceed 0.01 f/cc and correct procedures.

.4 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Contract Administrator will perform air monitoring within Asbestos Work Area.

.1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.

.2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

3.9 INSPECTION

.1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by Contract Administrator may result in Work stoppage, at no cost to City.

.2 Contract Administrator will inspect Work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Contract Administrator may order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

Part 1 General

1.1 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 O121-M1978(R2003), Douglas Fir Plywood.

.4 CSA O151-04, Canadian Softwood Plywood.

.5 CSA O153-M1980(R2003), Poplar Plywood.

.6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.

.7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.

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

.9 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.

1.2 SUBMITTALS

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

.2 Submit shop drawings for formwork and falsework.

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

.3 Submit WHMIS MSDS - Material Safety Data Sheets.

.4 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings Comply with CAN/CSA-S269.3 for formwork drawings.

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

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series or CSA-O153.

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

.3 Rigid insulation board: to CAN/ULC-S701.

.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, low VOC.

.4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

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

.6 Sealant: to Section 07 92 10 - Joint Sealing.

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 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.

.10 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

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

.12 Construct forms for architectural concrete, and place ties as indicated and as directed.

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

.13 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.

.14 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 5 days for walls and sides of beams.

.2 5 days for columns.

.3 7 days for beam soffits, slabs, decks and other structural members, or 7 days when replaced immediately with adequate shoring to standard specified for falsework.

.4 3 days for footings and abutments.

.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 Space reshoring in each principal direction at not more than 3000 mm apart.

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

END OF SECTION

Part 1 General

1.1 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 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 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.

.6 CSA W186-M1990(R2002), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Reinforcing Steel Institute of Canada (RSIC)

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

1.2 SUBMITTALS

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

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

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

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator with identifying code marks to permit correct placement without reference to structural drawings.

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

.4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

.1 Provide type C tension lap splices unless otherwise indicated.

.5 Quality Assurance: in accordance with PART 2 - SOURCE QUALITY CONTROL.

.1 Mill Test Report: upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel.

.2 Upon request submit in writing to Contract Administrator 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 Contract Administrator.

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

.3 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.

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

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

.1 Provide in flat sheets only.

.6 Welded deformed steel wire fabric: to ASTM A497/A497M.

.1 Provide in flat sheets only.

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

.8 Mechanical splices: subject to approval of Contract Administrator.

.9 Plain round bars: to CSA-G40.20/G40.21.

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 Contract Administrator’s approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

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

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request, inform Contract Administrator 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 Contract Administrator.

.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 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 10 00 Concrete Forming and Accessories.

.2 Section 03 20 00 Concrete Forming.

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 C1017/C1017M-03, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .5 ASTM D412-98a(2002)e1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- .6 ASTM D624-00e1, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .7 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .8 ASTM D1752-04a, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.Canadian General Standards Board (CGSB)
- .9 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- .10 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.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 ACRONYMS AND TYPES

.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

.1 Type GU or GUb - General use cement.

.2 Type HS or HSb - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with CaO content less than 8%.

.3 GGBFS - Ground, granulated blast-furnace slag.

1.4 DESIGN REQUIREMENTS

.1 Alternative 1 - Performance: in accordance with CSA-A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

1.5 SUBMITTALS

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

.2 Submit WHMIS MSDS - Material Safety Data Sheets.

.3 At least 4 weeks prior to beginning Work, submit to Contract Administrator samples of following materials proposed for use:

.1 1 m length of each type of joint filler.

.2 1 m length of each type of waterstops.

.4 Submit testing results and reports for review by Contract Administrator and do not proceed without written approval when deviations from mix design or parameters are found.

.5 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.

.6 Concrete hauling time: submit for review by Contract Administrator deviations exceeding maximum allowable time of 90 minutes for concrete to be delivered to site of Work and discharged after batching.

1.6 QUALITY ASSURANCE

.1 Submit to Contract Administrator minimum4 weeks 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 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator.

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

.3 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Contract Administrator verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 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 90 minutes after batching.

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

.2 Deviations to be submitted for review by Contract Administrator.

.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 facility.

.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.

.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, Type HS.

.2 Blended hydraulic cement: Type HS6 to CAN/CSA-A3001.

.3 Supplementary cementing materials: with maximum 20% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA-A3001.

.4 Water: to CSA-A23.1.

.5 Aggregates: to CAN/CSA-A23.1/A23.2.

.6 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494

.7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA-A23.1/A23.2.

.1 Compressive strength: 50 MPa at 28 days.

.8 Curing compound: to CSA-A23.1/A23.2 white and ASTM C309,Type 1-chlorinated rubber.

.9 Mechanical waterstops: ribbed extruded PVC Arctic Grade of sizes indicated with shop welded prewelded corner and intersecting pieces with legs not less than 300 mm long.

.10 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, firm grade.

.3 Self-expanding standard cork: to ASTM D1752, Type II.

.11 Weep hole tubes: plastic.

.12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.

.13 Dampproofing:

.1 Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2.

.14 Polyethylene film: 0.152 mm thickness to CAN/CGSB-51.34.

2.2 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Uniformity:

.2 Placeability:

.3 Workability: free of surface blemishes loss of mortar colour variations segregation.

.4 Finishability: amount of bleeding.

.5 Set time:

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: S1.

.2 Minimum compressive strength at 56 age: 35 MPa.

.3 Intended application: foundation slabs and stairwells.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Concrete supplier's certification.

.2 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Uniformity:

.2 Placeability:

.3 Workability: free of loss of mortar, segregation.

.4 Set time:

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: S1.

.2 Minimum compressive strength at 56 age: 35 MPa.

.3 Intended application: cast-in-place concrete piles.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Concrete supplier's certification.

.3 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Uniformity:

.2 Placeability:

.3 Workability: free of surface blemishes loss of mortar colour variations segregation.

.4 Finishability: amount of bleeding.

.5 Set time:

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: N.

.2 Minimum compressive strength at 28 age: 30 MPa.

.3 Intended application: stairs and other concrete.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Concrete supplier's certification.

.4 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Uniformity:

.2 Placeability:

.3 Workability: free of loss of mortar, segregation.

.4 Finishability: amount of bleeding.

.5 Set time:

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: N.

.2 Minimum compressive strength at 28 age: 20 MPa.

.3 Intended application: masonry fill.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Concrete supplier's certification.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Contract Administrator’s approval before placing concrete.

.1 Provide 24 hours 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.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.Prior to placing of concrete obtain Contract Administrator approval of proposed method for protection of concrete during placing and curing in adverse weather.

.6 Protect previous Work from staining.

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

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

.9 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

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

.10 Do not place load upon new concrete until authorized by Contract Administrator.

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 Contract Administrator.

.2 Where approved by Contract Administrator, 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 Contract Administrator. Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.

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

.5 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 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.3 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.

.4 Install continuous vertical anchor slots at 800 mm on centre where concrete walls are masonry faced.

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

.6 Finishing and curing:

.1 Finish concrete in accordance with CSA-A23.1/A23.2.

.1 Schedule:

.2 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.3 Finish concrete floor to meet requirements of CSA-A23.1/A23.2. Class A.

.4 Provide swirl-trowelled finish unless otherwise indicated.

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

.7 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.Do not displace reinforcement when installing waterstops.

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

.4 Tie waterstops rigidly in place.

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

.6 Use factory welded corners and intersections unless otherwise approved by Contract Administrator.

.8 Joint fillers:

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

.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 construction 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 straightedge method.

3.4 FIELD QUALITY CONTROL

.1 Site tests: Conduct test and submit report as described in PART 1 - SUBMITTALS.

.1 Concrete pours.

.2 Slump tests.

.3 Air and concrete temperature strength testing for each 40 m^3 concrete placed and for each type of concrete placed each day.

.4 Set of 3 cylinders for compressive.

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

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

.3 City will pay costs of tests.

.4 Contract Administrator will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

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

.6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5 VERIFICATION

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Contract Administrator and provide verification of compliance.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM D 412-98a, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
- .2 ASTM D 2240-97e1, Standard Test Method for Rubber Property - Durometer Hardness.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.
- .2 CAN/CGSB-1.181-92, Ready Mixed Organic Zinc-Rich Coating.
- .3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 Canadian Standards Association (CSA)

- .1 CAN/CSA-A23.1/A23.2-94, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .2 CAN3-A23.3-94, Design of Concrete Structures for Buildings.
- .3 CAN3-A23.4-94, Precast Concrete - Materials and Construction.
- .4 CSA-A251-M1982R1998), Qualification Code for Manufacturers of Architectural and Structural Precast Concrete.
- .5 CSA-G30.15-M1983(R1991)(R1998), Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- .6 CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.
- .7 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .8 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .9 CSA-G279- M1982(R1998), Steel for Prestressed Concrete Tendons.
- .10 CSA-W47.1-92(R1998), Certification of Companies for Fusion Welding for Steel Structures.
- .11 CSA-W48.1-M1991(R1998), Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.
- .12 CSA-W59-M1989, Welded Steel Construction (Metal Arc Welding).
- .13 CSA-W186-M1990(R1998), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3 DESIGN REQUIREMENTS

.1 Design precast elements to CAN3-A23.3 and CAN3-A23.4 to carry handling stresses.

.2 Design precast elements to carry loads specified by drawings or as indicated, in accordance with 2005 National Building Code of Canada (NBC).

.3 Design connections/attachments of precast elements to load/forces specified by drawings and 2005 NBC.

.4 Submit 4 copies of detailed calculations and design drawings for typical precast elements and connections for Contract Administrator for review 4 weeks prior to manufacture.

1.4 PERFORMANCE REQUIREMENTS

.1 Tolerance of precast elements to CAN3-A23.4, Section 10.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures, and in accordance with CAN3-A23.3 and CAN3-A23.4 .

.2 Include the following items:

.1 Design calculations for items designed by manufacturer.

.2 Details of prestressed and non-prestressed members, reinforcement and their connections.

.3 Camber.

.4 Finishing schedules.

.5 Methods of handling and erection.

.6 Openings, sleeves, inserts and related reinforcement.

.3 Ensure each drawing submitted bears stamp and signature of qualified professional engineer registered or licensed in province of Manitoba, Canada.

1.6 QUALIFICATIONS

.1 Precast concrete elements to be fabricated and erected by manufacturing plant certified by Canadian Standards Association in appropriate categoryies according to CSA-A251.

.2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting Bid and to specifically verify as part of Bid that plant is currently certified in appropriate categoryies, Structural and Prestressed.

.3 Only precast elements fabricated in such certified plants to be acceptable to City, and plant certification to be maintained for duration of fabrication, erection until warranty expires.

.4 Welding companies certified to CSA-W47.1.

1.7 WARRANTY

.1 Contractor hereby warrants that precast element will not spall or show visible evidence of corrosion of embedded steel and cracking, except for normal hairline shrinkage cracks, but for 1 year.

Part 2 Products

2.1 MATERIALS

.1 Cement, aggregates, water, admixtures: to CAN/CSA-A23.1 and CAN3-A23.4.

.2 Reinforcing steel: to CAN/CSA-G30.18.

.3 Prestressing steel tendons and bars: to CAN/CSA-S6 and CSA-G279.

.4 Welded wire fabric: to CSA-G30.15.

.5 Hardware and miscellaneous materials: to CAN/CSA-A23.1.

.6 Forms: to CAN3-A23.4.

.7 Anchors and supports: to CAN/CSA G40.21 Type 300 W galvanized after fabrication.

.8 Welding materials: to CSA-W48.1.

.9 Welding electrodes: to CSA-W48.1 and certified by Canadian Welding Bureau.

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

.11 Zinc-rich primer: to CAN/CGSB-1.181.

.12 Bearing pads: smooth, steel.

.13 Air entrainment admixtures: to ASTM C260-01.

.14 Chemical admixtures: to ASTM C494.

.15 Shims: steel.

2.2 MIXES

.1 Concrete.

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

.1 Cement: use Type GU Portland cement or Type GUb blended hydraulic cement Portland cement and Type F flax ash supplementary cementing materials.

.2 Minimum compressive strength at 28 days: 30 MPa.

.3 Class of exposure: F2.

.4 Nominal size of coarse aggregate: 20 mm.

.5 Chemical admixtures: type air entrainment.

.2 Grout.

.1 Shrinkage compensating grout: to Section 03 30 00 - Cast-in-Place Concrete.

2.3 MANUFACTURED UNITS

.1 Manufacture units in accordance with CAN3-A23.4, and CSA-A251.

.2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit which will not be exposed.

.3 Provide hardware suitable for handling elements.

.4 Design tendons and anchorages in accordance with CAN3-A23.3 CAN/CSA-S6.

.5 Galvanize anchors steel embedments after fabrication and touch up with zinc-rich primer after welding.

2.4 FINISHES

.1 Finish units to finish grade A to CAN3-A23.4, Section 24.

2.5 SOURCE QUALITY CONTROL

.1 Provide Contract Administrator with certified copies of quality control tests related to this project as specified in CAN3-A23.4 and CSA-A251 CSA-G279.

.2 Inspect prestressed concrete tendons in accordance with CSA-G279.

.3 Provide records from in-house quality control programme based upon plant certification requirements to Contract Administrator for inspection and review.

.4 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.

.5 Precast plants should keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and provide to Contract Administrator for review upon request.

Part 3 Execution

3.1 ERECTION

.1 Do precast concrete work in accordance with CAN3-A23.4 and CAN3-A23.3.

.2 Do welding in accordance with CSA-W59, for welding to steel structures and CSA-W186, for welding of reinforcement.

.3 Non-cumulative erection tolerances in accordance with CAN3-A23-4, Section 10.

.4 Set elevations and alignment between units to within allowable tolerances before connecting units.

.5 Fasten precast units in place as indicated on reviewed shop drawings.

.6 Do not weld or secure bearing plates at sliding joints.

.7 Install precast concrete closures between stems of flanged units where indicated.

.8 Clean field welds with wire brush and touch-up galvanized finish with zinc-rich primer.

3.2 CLEANING

.1 Obtain approval of cleaning methods from Contract Administrator before cleaning soiled precast concrete surfaces.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 00 - Cast-in-Place Concrete.

.3 Section 04 05 12 - Mortar and Masonry Grout.

.4 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.5 Section 04 05 23 - Masonry Accessories.

.6 Section 04 21 13 - Brick Masonry.

.7 Section 04 22 00 - Concrete Unit Masonry.

.8 Section 05 50 00 - Metal Fabrications.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-A165 Series-94(R2000), Standards on Concrete Masonry Units.

.2 CSA A179-94(R1999), Mortar and Grout for Unit Masonry.

.3 CSA-A371-94 (R1999), Masonry Construction for Buildings.

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.

.1 Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.

.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, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, handle and protect materials.

.2 Deliver materials to job site in dry condition.

.3 Storage and Protection.

.1 Keep materials dry until use except where wetting of bricks is specified.

.2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.6 SITE CONDITIONS

.1 Site Environmental Requirements.

.1 Cold weather requirements.

.1 Supplement Clause 5.15.2 of CSA-A371 with following requirements.

.1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.

.2 Maintain ambient temperature between 5 degrees C and 50 degrees C and protect site from windchill.

.2 Hot weather requirements.

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

Part 2 Products

2.1 MATERIALS

.1 Masonry materials are specified in Related Sections.

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 PREPARATION

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

3.3 INSTALLATION

.1 Do masonry work in accordance with CSA-A371 except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.4 CONSTRUCTION

.1 Exposed masonry.

.1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, Clause 82.1, in exposed masonry and replace with undamaged units.

.2 Jointing.

.1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.

.2 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.

.3 Cutting.

.1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges.

.4 Building-In.

.1 Build in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Wetting of bricks.

.1 Except in cold weather, wet bricks having an initial rate of absorption exceeding 1 g/minute/1000 mm^2: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.

.2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.

.6 Support of loads.

.1 Use 20 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.

.2 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

.7 Provision for movement.

.1 Leave 3 mm space below shelf angles.

.2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.3 Built masonry to tie in with stabilizers, with provision for vertical movement.

.8 Loose steel lintels.

.1 Install loose steel lintels. Centre over opening width.

.9 Control joints.

.1 Construct continuous control joints as indicated.

.10 Expansion joints.

.1 Build-in continuous expansion joints as indicated.

.11 Interface with other work.

.1 Cut openings in existing work as indicated.

.2 Make good existing work. Use materials to match existing.

3.5 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

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

3.7 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 04 05 10 - Common Work Results for Masonry.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA A179-94(R1999), Mortar and Grout for Unit Masonry.

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 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's mortar, grout, parging, colour additives and admixtures.

.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.

.1 Submit laboratory test reports.

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

Part 2 Products

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Mortar and grout: CSA A179.

.3 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.4 Mortar for exterior masonry above grade:

.1 Loadbearing: type S based on Property specifications.

.2 Non-Loadbearing: type S based on Property specifications.

.3 Parapet walls, chimneys, unprotected walls: type S based on Property specifications.

.5 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: type M based on Property specifications.

.6 Mortar for interior masonry.

.1 Loadbearing: type S based on Property specifications.

.2 Non-Loadbearing: type N based on Property specifications.

.7 Following applies regardless of mortar types and uses specified above:

.1 Mortar for calcium silicate brick and concrete brick: type O based on Proportion specifications.

.2 Mortar for stonework: type N based on Property specifications.

.3 Mortar for grouted reinforced masonry: type S based on Property specifications.

.4 Mortar for pointing: type N based on Proportion specifications.

.8 Non-Staining mortar: use non-staining masonry cement for cementitious portion of specified mortar type.

.9 Grout: to CSA A179, Table 3.

2.2 MIXES

.1 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

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 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.

3.3 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 01 33 00 - Submittal Procedures.

.2 Section 04 05 10 - Common Work Results for Masonry.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

- .1 CAN/CSA-A23.1/A23.2-00, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .2 CSA-A370-94(R1999), Connectors for Masonry.
- .3 CSA-A371-94(R1999), Masonry Construction for Buildings.
- .4 CSA G30.14-M1983(R1998), Deformed Steel Wire For Concrete Reinforcement.
- .5 CAN/CSA G30.18-M92, Billet-Steel Bars for Concrete Reinforcement.
- .6 CSA-S304.1-94(R2001), Masonry Design for Buildings.
- .7 CSA W186-M1990(R1998), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .8 CSA A179-94, Mortar and Grout For Unit Masonry.

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 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

.2 Shop Drawings:

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings consist of bar bending details, lists and placing drawings.
- .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.3 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.

Part 2 Products

2.1 MATERIALS

.1 Bar reinforcement: to CSA-A371 and CAN/CSA G30.18, Grade 400 W.

.2 Wire reinforcement: to CSA-A371 and CSA G30.14, truss type.

.3 Connectors: to CSA-A370 and CSA-S304.

.4 Corrosion protection: to galvanized to CSA-S304 and CSA-A370.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.

.2 Fabricate connectors in accordance with CSA-A370.

.3 Obtain Contract Administrator’s approval for locations of reinforcement splices other than shown on placing drawings.

.4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

.5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 2 weeks prior to commencing reinforcement work.

.2 Upon request inform Contract Administrator of proposed source of material to be supplied.

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 GENERAL

.1 Supply and install masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371, CAN/CSA-A23.1 and CSA-S304.1 unless indicated otherwise.

.2 Prior to placing concrete, obtain Contract Administrator’s approval of placement of reinforcement and connectors.

.3 Supply and install additional reinforcement to masonry as indicated.

3.3 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CSA-S304, CSA-A371 and as indicated.

.2 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CSA-A371 and as indicated.

3.4 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371, and CSA-A179.

3.5 GROUTING

.1 Grout masonry in accordance with CSA-S304.1, CSA-A371 and CSA-A179 and as indicated.

3.6 ANCHORS

.1 Supply and install metal anchors as indicated.

3.7 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.8 MOVEMENT JOINTS

.1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.9 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Contract Administrator.

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

.3 Replace bars and connectors which develop cracks or splits.

3.10 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

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 01 33 00 - Submittal Procedures.

.2 Section 04 05 10 - Common Work Results for Masonry.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

1.2 REFERENCES

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

.1 ASTM D2240-02b, Standard Test Method for Rubber Property - Durometer Hardness.

.2 Canadian Standards Association (CSA International).

.1 CSA-A371-94(R1999), Masonry Construction for Buildings.

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 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's for joint fillers and lap adhesives.

.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.

Part 2 Products

2.1 MATERIALS

.1 Control joint filler: purpose-made elastomer 50 durometer hardness to ASTM D2240 of size and shape indicated.

.2 Lap adhesive: recommended by masonry flashing manufacturer.

.3 Weep hole vents: purpose-made PVC.

.4 Polyethylene flashings.

.1 Plain: .75 mm thick polyethylene film bonded to asphalt treated creped kraft.

.2 Reinforced: two .75 mm thick polyethylene films bonded each side of asphalt treated creped kraft paper, reinforced with 12.7 x 12.7 mm fibreglass scrim.

.5 Aluminum flashings.

.1 Aluminum foil, .004 mm thick, asphalt laminated between two sheets of creped kraft paper with one exposed paper surface coated with asphalt-wax treatment.

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 INSTALLATION

.1 Install continuous control joint fillers in control joints at locations indicated on drawings.

.2 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

3.3 CONSTRUCTION

.1 Build in flashings in masonry in accordance with CSA-A371.

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.

.2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:

.1 For masonry backing embed flashing 25 mm in joint.

.2 For concrete backing, insert flashing into reglets.

.3 For wood frame backing, staple flashing to walls behind sheathing paper.

.4 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.

.3 Lap joints 150 mm and seal with adhesive.

3.4 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 01 33 00 - Submittal Procedures.

.2 Section 04 05 10 - Common Work Results for Masonry.

.3 Section 04 05 12 - Mortar and Masonry Grout.

.4 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.5 Section 04 05 23 - Masonry Accessories.

1.2 REFERENCES

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

.1 ASTM C126-99, Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.

.2 Brick Industry Association (BIA).

.1 Technical Note No. 20-2000, Cleaning Brick Masonry.

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA A82.1-M87(R1999), Burned Clay Brick (Solid Masonry Units Made From Clay or Shale).

.2 CSA-A165 Series-94(R2000), CSA Standards on Concrete Masonry Units.

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.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Face brick.

.1 Burned clay brick: to CAN/CSA A82.1.

.1 Type: 1.

.2 Grade: SW.

.3 Size: to match existing.

.4 Colour and texture: to match existing.

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 INSTALLATION

.1 Bond: stretcher.

.2 Coursing height: 200 mm for three bricks and three joints.

.3 Jointing: concave where exposed or where paint or similar thin finish coating is specified.

.4 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.

.5 Clean unglazed clay masonry as work progresses.

3.3 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Clean unglazed clay masonry as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, protect windows, sills, doors, trim and other work, and clean brick masonry as follows.

.1 Remove large particles with wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.

.2 Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose. Alternatively, use proprietary compound recommended by brick masonry manufacturer in accordance with manufacturer's directions.

.3 Repeat cleaning process as often as necessary to remove mortar and other stains.

.4 Use acid solution treatment for difficult to clean masonry as described in Technical Note No.20 by the Brick Industry Association.

.3 Clean glazed clay masonry as work progresses using soft, clean cloths, within few minutes after laying.

.1 Upon completion, when mortar has set so that it will not be damaged by cleaning, clean with soft sponge or brush, and clean water. Polish with soft, clean cloths.

.4 Clean concrete brick masonry as work progresses.

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of brick and finally by brushing.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 05 10 - Common Work Results for Masonry.

.2 Section 04 05 12 - Mortar and Masonry Grout.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 05 23 - Masonry Accessories.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN3 A165 SERIES-94(R2000), CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3.

Part 2 Products

2.1 MATERIALS

.1 Standard concrete block units: to CAN3-A165 Series (CAN3-A165.1).

.1 Classification: H/ 20/ A/ M.

.2 Size: modular.

.3 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Concrete block units.

.1 Bond: running.

.2 Coursing height: to match existing for one block and one joint.

.3 Jointing: concave where exposed or where paint or other finish coating is specified.

.2 Concrete block lintels.

.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.2 End bearing: not less than 200 mm.

3.2 CLEANING

.1 Standard block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 City of Winnipeg CW 1110 – General Instructions.

1.2 REFERENCES

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

- .1 ASTM A36/A36M-01, Specification for Structural Steel.
- .2 ASTM A193/A193M-01b, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
- .3 ASTM A307-00, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- .4 ASTM A325-02, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .5 ASTM A325M-00, Specification for High-Strength Bolts for Structural Steel Joints Metric.
- .6 ASTM A490M-00, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).

.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 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .2 CISC/CPMA 2-75, Quick-Drying, Primer 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 W48-01, Filler Metals and Allied Materials for Metal Arc Welding.
- .8 CSA W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .9 CSA W59-M1989(R2001), Welded Steel Construction (Metal Arc Welding) Metric.

.5 Master Painters Institute

.1 MPI-INT 5.1-98, Structural Steel and Metal Fabrications.

.2 MPI-EXT 5.1-98, Structural Steel and Metal Fabrications.

.6 The Society for Protective Coatings (SSPC)

.1 SSPC SP-6/NACE No. 3-00, Commercial Blast Cleaning.

1.3 DESIGN REQUIREMENTS

.1 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.

.2 Shear connections:

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

.2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

.3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Provinces of Manitoba, Canada for non standard connections.

1.4 SHOP DRAWINGS

.1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 – Submittal Procedures.

.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 provinces of Manitoba, Canada.

1.5 SAMPLES

.1 Submit samples in accordance with City of Winnipeg CW 1110 – General Instructions.

.2 Prepare sample of typical exposed structural connections in accordance with AISC Specifications of Architecturally exposed structural steel for approval of Contract Administrator. Samples to be judged upon alignment of surfaces, uniform contact between surfaces, smoothness and uniformity of finished welds. When approved, sample

units will serve as a standard for workmanship, appearance and material acceptable for entire project.

1.6 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: to CAN/CSA-G40.20/G40.21, Grade as indicated 300W and/or CAN/CSA-S136.

.2 Anchor bolts: to CAN/CSA-G40.20/G40.21, Grade 300W ASTM A36/A36M.

.3 High strength anchor bolts: to ASTM A193/A 93M, Grade.

.4 Bolts, nuts and washers: to ASTM A307, ASTM A325, ASTM A325M, ASTM A490/A490M.

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

.6 Shop paint primer: to CISC/CPMA1, CISC/CPMA2, SSPC SP-6.

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

.8 Shear studs: to CSA W59, Appendix H.

2.2 FABRICATION

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

.2 Install shear studs in accordance with CSA W59.

.3 Continuously seal members by continuous welds, intermittent welds and plastic filler where indicated. Grind smooth.

2.3 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136, MPI, INT 5.1, EXT 5.1, except where members to be encased in concrete.

.2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC-SP-6.

.3 Apply one coat of primer in shop to steel surfaces to achieve minimum dry film thickness of 2 to 3 mils, except:

.1 Surfaces to be encased in concrete.

.2 Surfaces to receive field installed stud shear connections.

.3 Surfaces and edges to be field welded.

.4 Faying surfaces of friction-type connections.

.5 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16, 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 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.3 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.

3.4 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 Contract Administrator.

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

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

3.5 FIELD PAINTING

.1 Paint in accordance with Section 09 91 23 - Painting.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP-6 except as specified otherwise. Apply in accordance with CAN/CGSB 85.10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 00 - Cast-in-Place Concrete.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 05 10 - Common Work Results for Masonry.

.5 Section 09 91 23 - Interior Painting.

.6 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

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

.1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.

.2 ASTM A269-02, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International)

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

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

.3 CAN/CSA-S16.1-01, Limit States Design of Steel Structures.

.4 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-1989(R2001),Welded Steel Construction (Metal Arc Welding) (Imperial Version).

.4 The Environmental Choice Program

.1 CCD-047a-98, Paints, Surface Coatings.

.2 CCD-048-98, Surface Coatings - Recycled Water-borne.

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 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:

.1 For finishes, coatings, primers and paints.

.2 Shop Drawings

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

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

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.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials.

.2 Storage and Protection:

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.

.2 Steel pipe: to ASTM A53/A53M extra strong galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

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

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

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

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

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.2 Shop coat primer: to CAN/CGSB-1.40.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.4 ISOLATION COATING

.1 Isolate aluminium from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

2.6 ANGLE LINTELS

.1 Steel angles: galvanized, sizes indicated for openings. Provide 150 mm minimum bearing at ends.

.2 Weld or bolt back-to-back angles to profiles as indicated.

2.7 PIPE RAILINGS

.1 Steel pipe: formed to shapes and sizes as indicated.

.2 Galvanize pipe railings after fabrication unless they are stainless steel.

2.8 ACCESS COVERS AND FRAMES

.1 Fabricate covers from raised pattern plate.

.2 Fabricate frames from angles to shapes and sizes as indicated.

.3 Finish: galvanized steel covers and frames unless they are stainless steel.

Part 3 Execution

3.1 ERECTION

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

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

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

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

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 PIPE RAILINGS

.1 Install pipe railings to stairs and on wet well area.

.2 Set railing standards in concrete. Grout to fill hole. Trowel surface smooth and flush with adjacent surfaces.

3.3 ACCESS COVERS

.1 Install access covers in locations as indicated.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 00 - Cast-in-Place Concrete.

.3 Section 04 05 10 - Common Work Results for Masonry.

.4 Section 05 50 00 - Metal Fabrications.

.5 Section 09 91 23 - Interior Painting.

.6 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

.1 ANSI/NAAMM MBG531-00, Metal Bar Grating Manual.

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

.1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A325M-02, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.4 Canadian General Standards Board (CGSB)

.5 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.6 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

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

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

.3 Canadian Standards Association (CSA International)

.1 CSA W59-1989(R2001), Welded Steel Construction (Metal Arc Welding/Imperial Version).

.4 National Association of Architectural Metal Manufactures (NAAMM)

.1 AMP 510-92, Metal Stair Manual.

.5 Steel Structures Painting Council (SSPC), Systems and Specifications Manual, Volume 2.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.2 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.

.3 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

1.4 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 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:

.1 For finishes, coatings, primers and paints.

.2 Shop Drawings

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

.2 Indicate construction details, sizes of steel sections and thickness of steel sheet.

.3 Submit shop drawing bearing stamp of a qualified professional engineer registered in The Province of Manitoba.

Part 2 Products

2.1 MATERIALS

.1 Steel sections: to CAN/CSA-G40.20/G40.21 Grade 300 W.

.2 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black.

.3 Steel tubing: to CAN/CSA-G40.20/G40.21, Grade 350 W.

.4 Metal bar grating: to ANSI/NAAMM MBG 531, steel, Type W-19-4, with checkered plate abrasive corrugated nosings.

.5 Welding materials: to CSA W59.

.6 Bolts: to ASTM A307.

.7 High strength bolts: to ASTM A325M.

2.2 FABRICATION

.1 Fabricate to NAAMM, Metal Stair Manual.

.2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.

.3 Accurately form connections with exposed faces flush; mitres and joints tight. Make risers of equal height.

.4 Grind or file exposed welds and steel sections smooth.

.5 Shop fabricate stairs in sections as large and complete as practicable.

2.3 GRATING STAIRS

.1 Form steel grating treads and landings from metal bar grating to profile indicated and secure to stringers and supports as indicated. Form landings of steel grating and reinforce as required.

2.4 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/$m^2$to CAN/CSA-G164.

.2 Shop coat primer: to CAN/CGSB-1.40.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.5 SHOP PAINTING

.1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2.

.2 Apply one coat of shop primer except interior surfaces of pans.

.3 Apply two coats of primer of different colours to parts inaccessible after final assembly.

.4 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7 degrees C.

.5 Do not paint surfaces to be field welded.

Part 3 Execution

3.1 INSTALLATION OF STAIRS

.1 Install in accordance with NAAMM, Metal Stair Manual.

.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

.3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

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

.5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.2 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA B111-[1974(R1998)], Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-[M1978(R1998)], Douglas Fir Plywood.
- .4 CAN/CSA-O141-[91(R1999)], Softwood Lumber.
- .5 CSA O151-[M1978(R1998)], Canadian Softwood Plywood.
- .6 CAN/CSA-O325.0-[92(R1998)], Construction Sheathing.

.2 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber 2000.

1.2 QUALITY ASSURANCE

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

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

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

Part 2 Products

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

- .1 CAN/CSA-O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

- .1 Board sizes: "Standard" or better grade.
- .2 Dimension sizes: "Standard" light framing or better grade.
- .3 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

.1 Douglas fir plywood (DFP): to CSA O121, standard construction.

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

□

.3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.

2.3 ACCESSORIES

.1 Nails, spikes and staples: to CSA B111.

.2 Bolts: [12.5] mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, [explosive actuated fastening devices], recommended for purpose by manufacturer.

2.4 FINISHES

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

2.5 WOOD PRESERVATIVE

.1 Surface-applied wood preservative: Copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

Part 3 Execution

3.1 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 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.

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

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

.5 Install fascia backing, nailers, curbs and other wood supports as required and secure using [galvanized] [steel] fasteners.

.6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

.7 Install sleepers as indicated.

□

.8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.2 Erection

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

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

3.3 Schedules

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

3.4 ERECTION

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

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

3.5 SCHEDULES

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

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01330 - Submittal Procedures.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

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

.2 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S701-[01], Thermal Insulation, Polystrene, Boards and Pipe Coverings.

.3 Environmental Choice Program (EPC).

.1 CCD-016-[97], Thermal Insulation.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01330 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01330 - Submittal ProceduresIndicate VOC's insulation products and adhesives.

.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 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

Part 2 Products

2.1 INSULATION

.1 Rigid cellular polystyrene: to CAN/ULC-S701.

.1 Type: 4.

.2 Compressive strength: 170

.3 Thickness: as indicated.

.4 Size: 600 x 1200.

.5 Edges: ship lapped.

2.2 ACCESSORIES

.1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

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 after building substrate materials are dry.

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

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.5 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.

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

.7 Do not enclose insulation until it has been inspected and approved by Contract Administrator.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Contract Administrator 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 RIGID INSULATION INSTALLATION

.1 Employ thermal studs in accordance with manufacturer's recommendations.

3.5 PERIMETER FOUNDATION INSULATION

.1 Exterior application: extend boards as indicated. Install on exterior face of perimeter foundation wall with thermal studs.

3.6 CAVITY WALL INSTALLATION

.1 Install polystyrene insulation boards on outer surface of inner wythe of wall cavity utilizing thermal studs

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation methods providing airvapour barrier materials and assemblies.

.2 Air/vapour barrier materials to provide continuous seal between components of building envelope and building penetrations.

1.2 REFERENCES

.1 Canadian Construction Documents Committee

.1 CCDC 2 - Stipulated Price Contract.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.13M-[M87], Sealing Compound, One Component, Elastomeric Chemical Curing.

.2 CAN/CGSB-19.18M-[M87], Sealing Compound, One Component, Silicone Base Solvent Curing.

.3 CAN/CGSB-19.24M-[M90], Multi-Component, Chemical Curing Sealing Compound.

.4 CGSB 19-GP-14M-[76], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.3 NBCC 1995; Part 5 - Environmental Separation

.4 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01330 - Submittal Procedures.

.2 Submit manufacturer’s product data sheets in accordance with Section 01330 - Submittal Procedures

.3 Submit manufacturer’s installation instructions in accordance with Section 01330 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.

1.5 QUALIFICATIONS

.1 Applicator: Company specializing in performing work of this section [with minimum 5 years documented experience with installation of air/vapour barrier systems. Completed installation must be approved by the material manufacturer. .

.2 Applicator: Company who is currently licensed by certifying organization must maintain their license throughout the duration of the project.

1.6 MOCK-UP

.1 Construct typical exterior wall panel 5m long by 0.800 m high.

.2 Locate where directed.

.3 Mock-up may remain as part of the Work.

.4 Allow 24 h for inspection of mock-up by Contract Administrator before proceeding with air/vapour barrier Work.

1.7 PRE- INSTALLATION MEETINGS

.1 Convene prior to commencing Work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

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

.2 Avoid spillage. Immediately notify Contract Administrator if spillage occurs and start clean up procedures.

.3 Clean spills and leave area as it was prior to spill.

1.9 PROJECT ENVIRONMENTAL REQUIREMENTS

.1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

.2 Ventilate enclosed spaces.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.10 WARRANTY

.1 For sealant and sheet materials the 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to 24 months.

Part 2 Products

2.1 SHEET MATERIALS

.1 Sheet Seal Type 1: Self-Adhesive bitumin laminated to high-density polyethylene film,

.1 Acceptable material: Grace ‘Perma-Barrier’.

.2 Sheet Seal Type 2: Thermofusable elastomeric bitumin membrane reinforced with a glass mat.

.1 Acceptable material: Soprema ‘Sopra-flam’

.3 Foam Seal [Type [4]]: Spray-applied medium density spray polyurethane foam insulation/air/vapour barrier.

2.2 SEALANTS

.1 Sealants in accordance with Section 079210 - Joint Sealers.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept the Work of this section.

.2 Ensure all surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer=s requirements.

.3 Report any unsatisfactory conditions to the Contract Administrator in writing.

.4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.

3.2 PREPARATION

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure all substrates are free of surface moisture prior to application of [self-adhesive] membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.3 INSTALLATION

.1 Install materials in accordance with manufacturer's instructions.

.2 Install sheet seal between window and door frames and adjacent wall seal materials with sealant and mechanically fastened galvanized metal cleats

.3 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.4 PROTECTION OF WORK

.1 Do not permit adjacent work to damage work of this section.

.2 Ensure finished Work is protected from climatic conditions.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Metal Flashing and Trim: Section 076200.

.2 Joint Sealers: Section 079210.

1.2 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 36-95b, Specification for Gypsum Wallboard.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.

.2 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.3 CGSB 37-GP-15M-76, Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.

.4 CGSB 37-GP-19M-76, Cement, Plastic, Cutback Tar.

.5 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.

.6 CGSB 37-GP-56M-80, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

.7 CAN/CGSB-51.20-M87 Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 Canadian Standards Association (CSA)

.1 CSA A123.4-M1992, Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

.2 CSA A231.1-1972, Precast Concrete Paving Slabs.

.3 CAN/CSA-A247-M86, Insulating Fibreboard.

.4 CSA A284-1976, Mineral Aggregate Thermal Roof Insulation.

.5 CSA O121-M1978, Douglas Fir Plywood.

.6 CSA O151-M1978, Canadian Softwood Plywood.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.

.2 Indicate flashing, control joints, tapered insulation details.

.3 Provide layout for tapered insulation.

1.4 Storage and Handling

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store rolls of felt and membrane in upright position. Store membrane rolls with selvage edge up.

.3 Remove only in quantities required for same day use.

.4 Place plywood runways over work to enable movement of material and other traffic.

.5 Store sealants at +5EC minimum.

.6 Store insulation protected from daylight and weather and deleterious materials.

1.5 Environmental Requirements

.1 Do not install roofing when temperature remains below -18EC for torch application, or -10EC to manufacturers' recommendations for mop application.

.2 Minimum temperature for solvent-based adhesive is -5EC.

.3 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.6 Protection

.1 Fire Extinguishers: maintain one stored pressure rechargeable type with hose and shut-off nozzle, ULC labeled for A, B and C class protection.

.2 Maintain fire watch for 1 hour after each day’s roofing operations cease.

1.7 Warranty

.1 For the Work of this Section 075200 - Modified Bituminous Roofing, the 12 months warranty period prescribed in General Conditions "C" is extended to 24 months.

.2 Contractor hereby warrants that modified bituminous roofing and membrane flashings will stay in place and remain leakproof in accordance with General Conditions, but for two years.

1.8 Compatibility

.1 Compatibility between components of roofing system is essential. Provide written declaration to Contract Administrator stating that materials and components, as assembled in system, meet this requirement.

1.9 Quality Assurance

.1 Submit laboratory test reports.

Part 2 Products

2.1 Deck Covering

.1 Gypsum board sheathing: to ASTM C 36 Standard 12.7 mm thick.

.2 Sand: natural silica sand passing 1-18 mm sieve.

2.2 Deck Primer

.1 Asphalt primer: to CGSB 37-GP-9Ma.

2.3 Vapour Retarder

.1 Base sheet vapour retarder: to CGSB 37-GP-56M, Styrene-Butadiene-Styrene (SBS) elastomeric polymer glass reinforcement, weighing 100 g/m ^{2} .

2.4 Membrane

.1 Base sheet: to CGSB 37-GP-56M, Styrene-Butadiene-Styrene (SBS) elastomeric polymer glass reinforcement, weighing 180 g/m^2.

.1 Type 1, fully adhered.

.2 Cap sheet: to CGSB 37-GP-56M, Styrene-Butadiene-Styrene (SBS) elastomeric polymer glass reinforcement, weighing 250 g/m^2.

.1 Type 1, fully adhered.

2.5 Bitumen

.1 Asphalt: to CSA A123.4, Type 2.

2.6 Polystyrene Insulation

.1 To CAN/CGSB-51.20, Type 4, thickness as indicated, square edges. Only polystyrene insulations listed on CGSB Qualified Products List (51 GP Series) are acceptable for use on this project.

2.7 Sealers

.1 Plastic cement: asphalt, to CAN/CGSB-37.5 coal tar, to CGSB 37-GP-19M.

.2 Sealing compound: to CAN/CGSB-37.29, rubber asphalt type.

2.8 Fasteners

.1 Covering to steel deck: No. 10 flat head, self tapping, Type A or AB, cadmium plated screws to CSA B35.3.

.2 Insulation to deck: fasteners and plates must meet Factory Mutual 4470 Standard for wind uplift and corrosion resistance.

.3 -slip finish with 51 mm plain margin around perimeter.

2.9 Paver Pedestals

.1 Pedestals and levelling plates made of high density polyethylene with integral spacer ribs on upper surface.

Part 3 Execution

3.1 Workmanship

.1 Do roofing work in accordance with applicable, standard in Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual .Do priming for asphalt roofing in accordance with CGSB 37-GP-15M.

3.2 Protection

.1 Cover walls and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Contract Administrator.

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.

3.3 Examination of Roof Decks

.1 Examine roof decks and immediately inform Contract Administrator.

.2 Prior to commencement of work ensure:

- .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris.
- .2 Curbs have been built.
- .3 Roof drains have been installed at proper elevations relative to finished roof surface.
- .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

3.4 Deck Covering

.1 Mechanically fasten to steel deck with screws spaced 400 mm o/c each way.

.2 Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs.

3.5 Vapour Retarder (Concrete/Gypsum Board/Plywood Deck)

.1 Embed vapour retarder in hot bitumen spread at rate of 1.2 kg/m^2.

3.6 Exposed Membrane Roofing Application

.1 Insulation: fully adhered, adhesive application.

.1 Adhere insulation to laminated vapour barrier using solvent-based adhesive.

.2 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.3 Cut end pieces to suit.

.2 Insulation: fully adhered, bitumen application.

.1 Embed insulation in 1 to 1.5 kg/m^2 mopping of bitumen.

.2 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.3 Cut end pieces to suit.

.3 Tapered insulation application.

.1 Mop insulation to vapour retarder and top layer of insulation to bottom layer with hot asphalt at rate of 1 kg/m^2.

.2 Install tapered insulation as second insulation layer, in accordance with shop drawings. Stagger joints between layers 150 mm minimum.

.4 Base sheet application.

.1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.

.2 Unroll and embed base sheet in uniform coating of asphalt applied at rate of 1.2 kg/m^2, at 230EC.

.3 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.

.4 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.

.5 Application to be free of blisters, wrinkles and fishmouths.

.5 Cap sheet application.

.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.

.2 Unroll and embed cap sheet in uniform coating of asphalt applied at rate of 1.2 kg/m^2, EVT at point of contact.

.3 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.

.4 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.

.5 Application to be free of blisters, fishmouths and wrinkles.

.6 Do membrane application in accordance with manufacturer's recommendations.

.6 Flashings.

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.

.2 Torch base and cap sheet onto substrate in 1 metre wide strips.

.3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by mopping or torch welding.

.4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.

.5 Provide 75 mm minimum side lap and seal.

.6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.

.7 Do work in accordance with manufacturer's recommendations.

.7 Roof penetrations.

.1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with the manufacturer's recommendations and details.

3.7 Walkways

.1 Install walkway concrete paving slabs as indicated.

3.8 Field Quality Control

.1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Contract Administrator.

.2 Contract Administrator will pay for tests.

.3 Inspection and testing of roofing application will be carried out by testing laboratory designated by City.

.4 Costs of tests will be paid by City.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 The Aluminum Association Inc. (AA)

- .1 Aluminum Sheet Metal Work in Building Construction-2000.
- .2 AA DAF45-97, Designation System for Aluminum Finishes.

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

- .1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM A240/A240M-02, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .3 ASTM A591/A591M-98, Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
- .4 ASTM A606-01, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
- .5 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .6 ASTM A792/A792M-02, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .7 ASTM B32-00, Standard Specification for Solder Metal.
- .8 ASTM B370-98, Standard Specification for Copper Sheet and Strip for Building Construction.
- .9 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
- .10 ASTM D822-01, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canadian Roofing Contractors Association (CRCA)

- .1 Roofing Specifications Manual 1997.

.4 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
- .2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .3 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.5 Canadian Standards Association (CSA International)

- .1 CSA A123.3-98, Asphalt Saturated Organic Roofing Felt.
- .2 CSA-A440-00/A440.1-00 - A440-00, Windows / Special Publication A440.1-00, User Selection Guide to CSA Standard A440-00, Windows.
- .3 CSA B111-1974(R1998), Wire Nails, Spikes and Staples.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.5mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

.2 Stainless steel sheet: to ASTM A167 and ASTM A240/A240M, Type 304 with mill finish.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32, asphalt laminated 3.6 to 4.5 kg kraft paper, No. 15 perforated asphalt felt to CSA A123.3.

.4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.5 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.7 Solder: to ASTM B32, alloy composition Sn 50.

.8 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.

.9 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.

.2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AA-Aluminum Sheet Metal Work in Building Construction.

.3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.4 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of minimum 0.5 mm thick galvanized, prefinished steel.

2.5 SCUPPERS

.1 Form scuppers from 0.5 mm thick galvanized sheet metal.

.2 Sizes and profiles as indicated.

.3 Provide necessary fastenings.

Part 3 Execution

3.1 INSTALLATION

.1 Install sheet metal work in accordance with CRCA FL series details.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

.6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

.7 Insert metal flashing into reglets, under cap flashing to form weather tight junction.

.8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.

.9 Caulk flashing at reglet, cap flashing with sealant.

.10 Install pans, where shown around items projecting through roof membrane.

3.2 SCUPPERS

.1 Install scuppers as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Underwriter=s Laboratories of Canada (ULC)

.1 ULC-S115-1995, Fire Tests of Firestop Systems.

1.2 QUALITY ASSURANCE

.1 Firestopping and smoke sealing shall be by competent installers having minimum five (5) years experience in application of materials and systems being used, approved and trained by material or system manufacturer.

.2 Asbestos free firestopping and smoke seal materials and/or systems to provide closures to fire and smoke at openings around penetrations, and at openings and joints within fire separations and assemblies having a fire-resistance rating, including openings and spaces at perimeter edge conditions. System shall provide draft tight barriers to retard passage of flame and smoke, and firefighter's hose stream and passage of liquids. System shall provide and maintain fire resistance rating of adjacent floor, wall or other fire separation assembly acceptable to authorities having jurisdiction. Provide firestopping and smoke seals within mechanical (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside bus ducts) respectively and around outside of such mechanical and electrical assemblies where they penetrate rated fire separations.

.3 Firestopping and smoke seal materials shall conform to both the temperature and flame ratings of ULC-S115 and, where applicable, to ASTM E814, and other requirements of authorities having jurisdiction.

1.3 SUBMITTALS

.1 Submit shop drawings indicating ULC assembly number for each condition, required temperature rise and flame rating, hose stream rating, thickness, installation methods and materials of firestopping and smoke seals, damming materials, reinforcements, anchorages and fastenings, size of opening, adjacent materials and number of penetrations. Submit copies of current ULC listings for each system and certified copies of test reports verifying that firestopping and smoke seals meet or exceed specified requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and material safety data sheets acceptable to Ministry of Labour.

Part 2 Products

2.1 MATERIALS

.1 Certified and listed by ULC or WH in accordance with CAN4-S115 and bearing ULC or WH label, products shall be heat resistant, flexible, durable and compatible

with adjacent materials and finishes. System shall be self supporting at penetration capable to adhere and yet maintain its integrity while providing effective barrier against passage of flame, smoke and gases. Product shall provide flame and temperature rating in accordance with requirements of OBC for openings in respective fire resistance rated floor, wall or other assembly.

.2 Firestop Systems: Certified by ULC, WH and listed in ULC Guide No. 40 U19.

.3 Firestop System Components: Certified by ULC, WH and listed in ULC Guide No. 40 U19.13 under the Label Service of ULC.

.4 Cementitious Matrices: Minimum 2758 kPa (400 psi) compressive strength when cured, to retard cable tray warping within the firestop seal.

.5 Firestopping and Smoke Seals at Openings Where Reinstallation Occurs: An elastomeric or re-useable cementitious matrix or putty seal; do not use a permanent cementitious seal at such locations.

.1 Firestopping and smoke seals at openings around penetrations for electrical bus ducts, pipes, ductwork and other electrical and mechanical items requiring sound and vibration control or allowance for expansion, contraction and other movement: An elastomeric seal; do not use a cementitious or rigid seal at such locations.

.2 Firestopping and smoke seals at joints and spaces designed and required to allow movement such as building movement joints, deflection spaces, control joints, expansion joints, and similar locations shall be flexible, elastomeric seal suitable to withstand the required movement and capable of returning to original configuration without damage to seal and without adhesive or cohesive failure; do not use a cementitious or rigid seal at such locations.

.3 Primers: To manufacturer's recommendation for specific material, substrate, and end use.

.4 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

.5 Damming and Backup Materials, Supports and Anchoring Devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.6 Pipe and Duct Insulation and Wrappings: Compatible with firestopping systems.

.7 Intumescent Pads: Permanently pliable type.

.8 Intumescent Composite Sheet: Composite sheet, strip or precut shapes.

.9 Sealants and Putty For Vertical And Overhead Joints: Non-sagging.

.10 Sealants and fluid seals at floors: Self-levelling.

.11 Materials and products shall not cause stress, chemical or physical reaction, or other damage to penetrating items or adjacent materials.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure materials and products are compatible with abutting materials, coatings and finishes. Remove applied coatings and finishes as required to permit proper installation and adhesion.

.2 Ensure that pipe and duct insulation and wrappings occurring within openings to receive firestopping and smoke seal are installed prior to work of this Section and that insulation and wrapping within fire seals is a ULC listed component of the system to be installed, unless ULC certified assembly permits such other insulation and wrapping to remain within the assembly. Otherwise, precede installation of mechanical insulations or remove insulation from area of insulated pipe or duct where such pipes or ducts penetrate a fire separation. Coordinate work of this Section with the work of Division 15, Mechanical. Ensure the continuity and integrity of thermal and vapour barriers where such are removed, altered, or replaced, acceptable to Division 15 and the City.

.3 Apply firestopping and smoke seals in accordance with manufacturer's instructions and tested designs acceptable to authorities having jurisdiction to provide required temperature and flame rated seal, and to prevent passage of smoke and liquids.

.4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing. Completely fill and seal voids with firestopping and smoke seal materials. Do not cover up materials until full curing has taken place. Notify when completed installations are ready for inspection and prior to concealing or enclosing firestopping and smoke seals.

3.2 CLEANING

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application. Remove temporary dams after initial set of firestopping and smoke seal materials.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, preparation and application for caulking and sealants.

.2 Text to complete other various Sections containing sealant or caulking specifications.

1.2 REFERENCES

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

.1 ASTM C919-02, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

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

.1 Material Safety Data Sheets (MSDS).

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's product to describe.

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit manufacturer's instructions in accordance with City of Winnipeg CW 1110 – General Instructions.

.1 Instructions to include installation instructions for each product used.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

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, corrugated cardboard packaging material in appropriate on-site bins for recycling.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.6 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Contract Administrator.

.7 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.8 Fold up metal banding, flatten, and place in designated area for recycling.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Ventilate area of work as directed by Contract Administrator by use of approved portable supply and exhaust fans.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Urethanes One Part.

.1 Non-Sag to CAN/CGSB-19.13, Type 2, MCG-2-25, MCG-2-40.

.2 Silicones One Part.

.1 To CAN/CGSB-19.13.

2.3 SEALANT SELECTION

.1 Sealant as per manufacturer’s recommended product for specified use. Acceptable product Dow, Tremco, or equivalent.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant.

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01330 - Submittal Procedures.

.2 Section 079210 - Joint Sealers

.3 Section 087110 - Door Hardware-General

.4 Section 099113 – Exterior Painting.

.5 Section 099123 – Interior Painting.

1.2 REFERENCES

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

.1 ASTM A653/A653M-01a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B29-92(1997), Specification for Refined Lead.

.3 ASTM B749-97, Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

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

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

.4 Canadian Steel Door Manufacturers' Association, (CSDMA).

.1 CSDMA, Specifications for Commercial Steel Doors and Frames, 1990.

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-99, Standard for Fire Doors and Fire Windows.

.2 NFPA 252-99, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN4-S104-80(R1985), Fire Tests of Door Assemblies.

.2 CAN4-S105-85(R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01330 - Submittal Procedures.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware, fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings reinforcing, firerating and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.5 Submit test and engineering data, and installation instructions.

1.5 REQUIREMENTS

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with [CAN4-S104and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M,], minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M,.

.3 Composites: balance of core materials used in conjunction with lead: in accordance with manufacturers' proprietary design.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.

.2 Stiffened: face sheets welded, honeycomb / insulated core.

.1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m^3.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250^{o}C at 30 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

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

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09900 – Finish Painting. Protect weather strips from paint. Provide final finish shall be free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Door bottom seal: neoprene.

.5 Metallic paste filler: to manufacturer's standard.

.6 Fire labels: metal rivited.

.7 Sealant: as per section 079210.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm welded thermally broken type construction.

.4 Interior frames: 1.6 mm welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm o.c. maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush.

.2 Exterior doors: hollow steel] construction. Interior doors: honeycomb construction.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing.

.5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with [CAN4-S104] and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.10 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form each face sheet for exterior doors from 1.6 mm sheet steel with polyurethane core laminated under pressure to face sheets.

.2 Form each face sheet for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

.3

2.12 HOLLOW STEEL CONSTRUCTION

.1 Form each face sheet for exterior doors from 1.6 mm sheet steel.

.2 Form each face sheet for interior doors from 1.6 sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded laminated] to each face sheet at 150 mm on centre maximum.

.4 Fill voids between stiffeners of exterior doors with polyurethane core.

.5 Fill voids between stiffeners of interior doors with honeycomb core.

2.13 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08710 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor[and thresholds] as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor thresholds: 13 mm.

.3 Adjust operable parts for correct function.

3.4 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-69.17-[M86(R1993)], Bored and Preassembled Locks and Latches.

.2 CAN/CGSB-69.18-[M90]/ANSI/BHMA A156.1-[1981], Butts and Hinges.

.3 CAN/CGSB-69.19-[93]/ANSI/BHMA A156.3-[1984], Exit Devices.

.4 CAN/CGSB-69.20-[M90]/ANSI/BHMA A156.4-[1986], Door Controls (Closers).

.5 CAN/CGSB-69.21-[M90]/ANSI/BHMA A156.5-[1984], Auxiliary Locks and Associated Products.

.6 CAN/CGSB-69.22-[M90]/ANSI/BHMA A156.6-[1986], Architectural Door Trim.

.7 CAN/CGSB-69.24-[M90]/ANSI/BHMA A156.8-[1982], Door Controls - Overhead Holders.

.8 CAN/CGSB-69.26-[96]/ANSI/BHMA A156.10-[1991], Power-operated Pedestrian Doors.

.9 CAN/CGSB-69.28-[M90]/ANSI/BHMA A156.12-[1986], Interconnected Locks and Latches.

.10 CAN/CGSB-69.29-[93]/ANSI/BHMA A156.13-[1987], Mortise Locks and Latches.

.11 CAN/CGSB-69.30-[93]/ANSI/BHMA A156.14-[1991], Sliding and Folding Door Hardware.

.12 CAN/CGSB-69.31-[M89]/ANSI/BHMA A156.15-[1981], Closer/Holder Release Device.

.13 CAN/CGSB-69.32-[M90]/ANSI/BHMA A156.16-[1981], Auxiliary Hardware.

.14 CAN/CGSB-69.33-[M90]/ANSI/BHMA A156.17-[1987], Self-closing Hinges and Pivots.

.15 CAN/CGSB-69.34-[93]/ANSI/BHMA A156.18-[1987], Materials and Finishes.

.16 CAN/CGSB-69.35-[M89]/ANSI/BHMA A156.19-[1984], Power Assist and Low Energy Power Operated Doors.

.17 CAN/CGSB-69.36-[M90]/ANSI/BHMA A156.20-[1984], Strap and Tee Hinges and Hasps.

1.2 SUBMITTALS

.1 Product Data:

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

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.2 Samples:

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

.2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.3 After approval samples will be returned for incorporation in the Work.

.3 Hardware List:

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

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.5 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, door holders [electrified hardware] and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 General

2.1 QUALITY ASSURANCE

.1 Furnish services of an Architectural Hardware Consultant (AHC) for preparation of hardware shop drawings, keying, co-ordination with other Sections, consultation with the City and the Contract Administrator and for On-Site inspections.

.2 Inspect all hardware after installation by the Manufacturer's Representative who shall certify in writing to the City, that all hardware has been supplied and installed in accordance with the specifications and reviewed Shop Drawings, and are functioning properly.

.3 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.4 Provide to applicable Sections templates and information required for proper preparation and application of hardware in ample time to facilitate progress of Work.

.5 Before supplying and installing any hardware, carefully check Hardware Schedule, Drawings and Specifications. Verify door hands, door and frame material and operating conditions, and assure that hardware will fit work to which it is to be attached. Advise Contract Administrator in writing of required revisions.

.6 Templates: Check Hardware Schedule, Drawings and Specifications, and Supply promptly to applicable Sections any templates, template information and Manufacturer's literature, required for proper preparation for hardware, in ample time to facilitate progress of work.

.7 Provide services of competent mechanics for the installation of hardware. Make adjustments necessary to leave hardware in perfect working order. Provide written summary of work completed and status of all items, including any adjustments, revisions or modifications.

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.8 Maintenance Seminar: Instruct the City regarding proper care, cleaning and general maintenance.

.9 Source Limitations: Obtain each type of product from a single Manufacturer.

2.2 REGULATORY REQUIREMENTS

.1 Ensure hardware for fire-rated openings complies with requirements of authorities having jurisdiction, with door and frame Manufacturer's tested assemblies, and that hardware items bear labels acceptable to authorities having jurisdiction.

Part 3 Products

3.1 MATERIALS

.1 Type and Design: Matching in all respects to samples of hardware and finishes approved by City. Use one Manufacturer's products for all similar items.

.2 Metal Finishes: Free from defects, clean and unstained, and of uniform colour.

.3 Fire Rated Doors: Meeting requirements of ULC as part of fire rated door assembly, with ULC or WHI label, or as acceptable to authority having jurisdiction.

.4 Fasteners: Screws, bolts, expansion shields and other fastening devices as required for satisfactory installation and operating of hardware.

.1 Same finish as hardware to which it is to be fastened.

.5 Supply hardware complete with all necessary screws, bolts and other fastening of suitable size and type to anchor the hardware in position neatly and properly in accordance with the best practices and to the Contract Administrator's approval.

.6 Fastenings: All fastenings shall harmonize with the hardware materials and finishes.

.7 Hardware for fire rated and labelled door and frame assemblies: ULC listed or as accepted by authorities having jurisdiction.

.8 Following Manufacturer's are acceptable subject to review by the City of samples and list of items proposed.

.1 Hinges:

.1 All Doors: Full mortised, stainless steel, minimum 114 mm x 102 mm, heavy weight, 5 knuckles, ball bearing, stainless steel screws.

.2 Non Removal Pin: Out swinging exterior doors and where scheduled.

.3 Stamp hinge catalogue numbers on face of leaf of each hinge at factory to enable easy recognition of hinge material and manufacture after doors are hung.

.4 Where doors are required to swing to 180 degrees, Supply and Install hinges of sufficient throw to clear trim.

.2 Locksets:

.1 Type and Finish: Heavy duty, stainless steel construction, orb handle and raised escutcheon.

.2 Backset: 125 mm for exterior doors, 70 mm for interior doors.

.3 Cylinders: 6 pin cylinders.

.4 Strikes: Stainless Steel, ANSI standard size with curved lip strikes for latch bolts and no lip strikes for dead locks. Provide complete with wrought boxes finished to match strike.

.3 Closers:

.1 Hydraulically controlled and full rack and pinion operation, clear anodized aluminium arm and full cover.

.2 Adjustable closing speed, latch speed and back check control.

.3 Adjustable swing power.

.4 Install all necessary attaching brackets, mounting channels, cover plates where necessary for correct application of door closers.

.5 Parallel arms at out swinging exterior doors and at interior doors where specified.

.6 Delayed action for barrier free application.

.7 Coordinate closers with overhead holders.

.4 Construction Keying:

.1 Equip lock cylinders in construction system.

.2 The construction key system to be inoperative once the City's keys are inserted in the cylinders.

.5 Push Plates and Kickplates:

.1 Length: 40 mm (1½") less than door width for single doors and 20 mm (¾") less than door width for doors in pairs.

.2 Thickness: 1.3 mm (0.050"), free of rough or sharp edges. Corners and edges to be slightly radiuses.

.3 Installation: 3M tape.

.6 Surface Bolts:

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.1 Stainless steel top and bottom bolts, chain pull for top bolt.

.2 Dust free strikes.

.7 Door Stops:

.1 Surface mount, stainless steel retainer, half dome shaped neoprene stop.

.2 Install floor stops in manner so as not to create a tripping hazard and allows maximum opening of doors.

.3 Supply and Install door stops of height to engage doors.

.8 Astragals: Stainless steel bar with neoprene bulb.

.9 Weatherstrippings: Surface mounted extruded aluminium housing with neoprene bulb having spring mounted adjustment, 770A by Zero International.

.10 Door Bottoms: Surface mounted, extruded aluminium housing, pressure spring loaded neoprene bulb, 365A by Zero International.

.11 Thresholds: Extruded aluminium, high seat, except flat saddle for barrier free application.

3.2 KEYING SYSTEM

.1 Lay out keying system for building in consultation with the Contract Administrator. Keying system shall include keying alike, keying differently, keying in groups, master keying and grand-master keying locks and exit devices as required.

.2 Prepare and submit keying chart and related explanatory data for approval. Do not order cylinders until written confirmation of keying arrangements is received from the City.

.3 Stamp keys "DO NOT DUPLICATE".

.4 Provide two (2) change keys for each lock. Three (3) keys for each submaster level and six (6) grand master keys. In the case of keyed alike groups, supply six (6) cut keys only and supply the balance as blanks.

.5 Supply 1 Key Control System complete with cabinet and necessary components as Lund Model 1201, 2 tag system.

.6 Confirm with Contract Administrator and the City for shipping directions.

Part 4 Execution

4.1 PREPARATION

.1 Thoroughly check design and provide required hardware for openings to required detail.

.2 Trim undesignated openings with hardware of equal quality and design to that specified for similar opening.

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.3 Furnish door and frame Manufacturers with complete instructions and templates for preparation of their Work to receive hardware.

4.2 INSTALLATION

.1 Install finish hardware to template in accordance with Manufacturer's written instructions. Do not modify finish hardware without Manufacturer's written approval.

.2 Install finish hardware for fire rated doors in accordance with NFPA 80 requirements.

.3 Install finish hardware secure, plumb, level, and true to line.

.4 Cut and fit to substrates avoiding damage and weakening. Reinforce attachment substrate as necessary for proper installation and operation.

.5 Size cutouts so that hardware item completely covers cut out.

.6 Mortise work to correct location and size without gouging, splintering, and causing irregularities in exposed finish work.

.7 Where cutting and fitting is required on substrates to be painted or similarly finished, install, fit, and adjust hardware prior to finishing.

.8 Remove hardware and place in original packaging.

.9 Re-install hardware after finishing operation is complete.

.10 Install hardware items affixed to concrete and masonry with machine screws and threaded metal expansion shields.

.11 Set, fit and adjust hardware according to Manufacturer's templates and instructions. Hardware shall operate freely. Protect installed hardware from damage and paint spotting.

.12 Consult with manufacturer of security hardware items such as door monitoring equipment, card reader access equipment, electric strikes, and electric hinges operated by card access equipment and combination magnetic door holder releases/door closers and install in accordance with Manufacturer's recommendations under the Contractor’s supervision Sections Fire Detection and Alarm System. Use templates as supplied by Manufacturer for predrilling doors and frames.

.13 Pre-drill kickplates and doors before attachment of plates. Apply with water resistant adhesive and countersunk stainless steel screws.

.14 Weatherstrip exterior doors. Install effectively to tightly seal entire perimeter of door. Secure in place with non-ferrous screws, in accurate alignment.

.15 Maintain integrity of weather seal at head of doors fitted with closers. Adapt weatherstripping as required to achieve specified performance and provide any necessary accessories.

.16 After installation of hardware under this Section, check opening units for correct fit and uniformity of space around perimeter of units, or between units. Provide smoothly operating opening units free from binding.

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4.3 FIELD QUALITY CONTROL

.1 Have hardware Manufacturer's Representative visit Site and submit written report of each visit to Site, giving storage conditions and installation details, date and name of hardware Manufacturer's Representative.

.2 Before completion of Work but after hardware installation, have hardware Manufacturer's Representative inspect work and submit certificate to Contract Administrator stating that final inspection has been made and that hardware of proper type has been properly installed and adjusted, is in good working order and condition, and is in conformance with Contract requirements.

4.4 ADJUSTMENTS AND CLEANING

.1 Adjust and clean hardware according to Manufacturer's written instructions.

.2 Turn over construction keys and extractor key to the City and provide any required adjustment or modifications prior to Substantial Performance of the Contract.

.3 Hand over to the City Grand-master and master keys, Change Keys, Control Keys and Permanent Cylinders and core. The City will be responsible for interchanging temporary construction cores with permanent cylinder cores in locks. Temporary construction cores will be returned to Contractor.

4.5 EXTENDED WARRANTY

.1 Warrant work against defects in materials and quality of performance for a period of five (5) years for door closers and two (2) years for other hardware.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 This Section includes glazing Work not specified in other Sections. Refer to other Sections for other glazing.

1.2 SUBMITTALS

.1 Provide samples of materials as requested. Label samples with manufacturer's name, with registered name of product, weight, and quality of glazing material.

.2 Provide maintenance data of glass and glazing system used in this Project including cleaning instructions for incorporation into manual.

1.3 QUALITY ASSURANCE

.1 Perform Work in accordance with recommendations of Glazing Association of North America (GANA). Size glass to Code requirements and verify that openings for glazing are correctly sized and within tolerance.

.2 Glass Lites: Float, tempered, laminated or heat strengthened and in thicknesses in accordance with requirements of glass manufacturer as substantiated by the glass manufacturer's stress analysis for each location required, unless otherwise indicated.

.3 Design Conditions: Conforming to requirements of Division 8 Sections Curtain Wall and Entrances.

.4 Use a safety factor of 2.5:1 minimum for glass design.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.

.2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.5 WARRANTY

.1 Submit a 10 year warranty from Total Performance, against defects in the insulating glass units and warrant them to be free from material obstruction of vision as a result of dust or film formation on the internal glass surfaces by any cause, under design conditions, other than extrinsic glass breakage, but including breakage due to thermal shock and temperature differential due to inherent glass faults.

.1 The glass coatings will not discolour, oxidize, delaminate, or have scratches and pinholes and shall be uniform in thickness and uniform in colour throughout each glass unit and from glass unit to glass unit.

.2 Insulating glass units will be free from condensation, fogging material obstruction of vision as a result of dust or film formation on the internal glass surfaces by any cause under normal conditions.

.3 The insulating glass units will not change their mechanical design properties and shall not in any way deteriorate, degrade, delaminate or change their visual appearance.

Part 2 Products

2.1 MATERIALS

.1 Float Glass: CAN/CGSB-12.3, clear, glazing quality, minimum 6 mm (1/4") thick.

.2 Tempered Safety Glass: CAN/CGSB-12.1 Type 2, Class B, minimum 6 mm(1/4”) thick, heat treated using the horizontal tong free method, with roll-wave distortion parallel to bottom edge of glass as installed.

.3 Heat Strengthened Glass: ASTM C1048 Type HS, minimum 6 mm (1/4”) thick, heat treated using the horizontal tong free method, with roll-wave distortion parallel to bottom edge of glass as installed.

.4 Laminated Safety Glass: CAN/CGSB-12.1, Type 1, Class B, fabricated with minimum 1.6 mm clear polyvinylbutyral interlayer between 2 lites of minimum 3 mm (1/8”) thick glass, minimum overall 7.6 mm (5/16”) thick. Treat exposed edges of laminated glass susceptible to degradation by organic solvents and glazing compounds.

.5 Wired Glass: Clear, 6 mm (1/4") thick, polished Georgian 12 mm (1/2") square wire-reinforced, float glass, having the required fire resistance rating based on ULC testing.

.6 Tinted Glass: Heat absorbing glass, Solargray by PPG.

.7 Low Emissivity Coating: Solarban 60 by PPG.

.8 Ceramic Frit Coated Glass: Ceramic enamel applied by silk-screened process on No. 2 surface.

.9 Spandrel Glass: CAN2-12.9-M, minimum 6 mm (1/4") thickness or as indicated on Drawings, heat strengthened glass.

.10 Safety Scrim Backing: Self adhering polyester or polyethylene film 0.05 mm to 0.125 mm (2 mils to 5 mils) thick.

2.2 ACCESSORIES

.1 Glazing materials, primers and cleaning solvents: Mutually compatible, standard colours.

.2 Insulated Glass Unit Spacer Core: Extruded, thermoset polymer structural silicone foam tape with integrally incorporated desiccants, resistant to ozone, sunlight, oxidation, black, Super Spacer Premium Plus by Edgetech.

.3 Glazing Compound: CAN2-19.13, one component silicone base.

.4 Glazing Tape, Preshimed: Extruded, ribbon shaped, non-drying, non-skinning, non-oxidizing polyisobutylene tape with continuous synthetic rubber spacer rod, sufficiently wide and thick as to completely cover bite area of glazing unit when unit is pushed into place.

.5 Glazing Tape: Extruded, ribbon-shaped, non-drying, non-skinning, non-oxidizing, reinforced, polyisobutylene tape of sufficient width and thickness, 6 mm (1/4") minimum, to permit a continuous seal.

.6 Shims, Spacers and Setting Blocks: 45, 50 and 90 Durometer A hardness plus/minus 5 respectively, neoprene rubber. Resistance to sunlight, weathering, oxidation and permanent deformation under load shall be prime essentials of shims, spacers and setting blocks.

.7 Glazing Gaskets: Neoprene, EPDM, thermoplastic or other approved material, of sufficient thickness to be 25% compressed when installed. Gaskets shall have a 13.8 MPa (2000 psi) tensile strength, Durometer A hardness of 50, plus/minus 5, resistance to permanent set 30% maximum, minimum elongation at break of 300% and resistance to ozone showing no cracks.

.8 Safety Decals: 50 mm (2") diameter round, self-adhesive, pressure-sensitive, black, non-facing, decals with clear, colourless, non-yellowing adhesive.

2.3 FABRICATION

.1 Accurately size glass to fit openings allowing clearances recommended by Glass Association of North America. Cut glass clean and free of nicks and damaged edges. Grind smooth and polish exposed glass edges. Do not cut or abrade tempered, heat treated, or coated glass.

2.4 FABRICATION – INSULATING GLASS UNITS

.1 Insulating glass units: CAN2-12.8, double and triple glazed, composed of lites of minimum 6 mm thick glass separated by a 13 mm wide dehydrated air space, double sealed and atmospheric pressure equalized to prevent bowing of the glass lites in the vertical position. Edges of glass shall be straight cut, free of nicks and other imperfections conducive to breakage. Coatings used in structural glazing shall be edge deleted 10 mm.

.1 Sealing System: At Contractor’s option, dual seal with polyisobutylene primary and polysulfide secondary sealants, or dual seal with polyisobutylene primary and silicone secondary sealants.

.2 Set spacer core straight and even into glass units with a maximum variation in line of spacer core of plus or minus 2 mm (0.080”) and the primary seal not extend past the inside edge of spacer core by more than 1.6 mm (0.060”). Weld or vulcanize spacer core corners and joints.

2.5 GLASS AND GLAZING TYPES

.1 Exterior Vision Units: Double glazed Insulating glass units, tinted glass outer lite, clear glass inner lite with low emissivity coating on No. 3 surface.

.2 Exterior Spandrel Glass: Single glazed clear glass, ceramic frit coating and scrim backing on No.2 surface.

Part 3 Execution

3.1 INSPECTION

.1 Verify dimensions at the Site before proceeding with fabrication or glazing units.

.2 Ensure that openings are free from distortion, and that surfaces are free from protrusions that will obstruct face and edge clearances.

.3 Ensure that ferrous metals are painted or zinc coated; and that surfaces are suitable for adhesion of the glazing materials.

.4 Ensure that operable units to be glazed are adjusted for proper operation.

.5 Ensure that ambient and surface temperatures are above 5°C.

3.2 PREPARATION

.1 Free rabbets, stops and glass edges of dust, dirt, moisture, oil and other foreign matter detrimental to or obstructing the glazing material.

3.3 INSTALLATION - GENERAL

.1 Handle and install glass in accordance with manufacturer's directions. Prevent nicks, abrasions and other damage likely to develop stress on edges.

.2 Without limitations, cracked or scratched glass, shrinking, cracking, staining, hardening, sagging of glazing materials; loosening or rattling of glass; leaking of glazed joints will be rejected.

.3 Remove and replace glazing stops in original locations, using original fasteners, securely set and undamaged.

.4 Use setting blocks and spacers as required to properly support the glass, centred in place in the glazing space independent of the materials and to uniformly distribute its load.

.5 Use a minimum of 2 setting blocks, located at the quarter points. Locate spacers at jamb edges of glass, uniformly spaced at 600 mm (24") o.c. maximum, and 300 mm (12") maximum from top and bottom.

.6 Assess coloured glass units for colour uniformity and arrange to avoid abrupt variation in appearance.

.7 Set glass properly centred with uniform bite and face and edge clearance, free from twist, warp or other distortion likely to develop stress.

.8 Leave labels on glass until it has been set and inspected and approved. Leave glass whole and without cracks, scratches or other defects and with setting in perfect condition at completion, to the approval of the Contract Administrator.

.9 Remove rejected, broken or damaged glass due to defective materials or improper setting and replace with perfect materials. Units producing distorted vision will be rejected and replaced at the reasonable discretion of the Contract Administrator.

3.4 CLEANING

.1 Clean and make good to the approval of the Contract Administrator, surfaces soiled or otherwise damaged in connection with the Work of this Section. Pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.

.2 Upon completion of the Work, remove all debris, equipment and excess material resulting from the Work of this Section from the Site.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 02 61 33 - Hazardous Materials.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 09 91 23 - Painting of Interior Surfaces.

1.2 REFERENCES

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Contract Administrator.

.7 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90^0 to surface.

.2 Soffits: No defects visible from floor at 45^0 to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 SCHEDULING OF WORK

.1 Submit work schedule for various stages of painting to Contract Administrator for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Contract Administrator for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.5 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for paints and coating products to be used in accordance with Section 013300 - Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 Manufacturer's Material Safety Data Sheets (MSDS).

1.6 SAMPLES

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

.2 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.3 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

.4 Submit full range of available colours where colour availability is restricted.

1.7 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one - one four litre can of each type and colour of primer stain finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Contractor and store where directed.

1.8 DELIVERY, HANDLING AND STORAGE

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

.2 Deliver and store materials in original containers, sealed, with labels intact.

.3 Labels shall clearly indicate:

.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.4 Remove damaged, opened and rejected materials from site.

.5 Provide and maintain dry, temperature controlled, secure storage.

.6 Observe manufacturer's recommendations for storage and handling.

.7 Store materials and supplies away from heat generating devices.

.8 Store materials and equipment in a well ventilated area with temperature range 7^0C to 30^0C.

.9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Contract Administrator. After completion of operations, return areas to clean condition to approval of Consultant.

.11 Remove paint materials from storage only in quantities required for same day use.

.12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.13 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10^0C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Contract Administrator and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:

.1 ambient air and substrate temperatures are below 10 ^{0}C.

.2 substrate temperature is over 32 ^{0}C unless paint is specifically formulated for application at high temperatures.

.3 substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 the relative humidity is above 85% or when dew point is less than 3 ^{0}C variance between air/surface temperature.

.5 rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 Conduct moisture test using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple “cover patch test”.

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 ^{0}C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of the Contract Administrator such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 Paint primers listed in Section 05 12 23.

.2 Paint materials for paint systems shall be products of a single manufacturer.

2.2 COLOURS

.1 Contract administrator will provide colour schedule after Contract award. Colour schedule will be based upon four base colours and two accent colours.

.2 Selection of colours will be from manufacturers full range of colours.

.3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Contract Administrator’s written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Contract Administrator.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category/	Units @ 60E/	Units @ 60E/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on Finish Schedule.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Concrete Surfaces: (including horizontal soffits)

.1 EXT 3.1K - Latex finish (over alkali resistant primer).

.2 Structural Steel and Metal Fabrications:

.1 EXT 5.1A - Quick dry enamel semi-gloss finish.

.3 Steel - High Heat: pipes, flues, stacks, etc., with temperature range as noted

.1 EXT 5.2B - Heat resistant aluminum enamel finish, maximum 427 ^{0}C

Part 3 Execution

3.1 GENERAL

.1 Perform preparation and operations for exterior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Contract Administrator damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Contract Administrator. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Concrete: 12%.

.2 Clay and Concrete block/brick: 12%

.3 Wood: 15%.

3.3 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Contract Administrator.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants and general public in and about the building.

.5 Removal of light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.

.6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Contractor Administrator.

3.4 CLEANING AND PREPARATION

.1 Clean and prepare exterior surfaces in accordance with MPI Painting Specification Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by brushing, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent (and bleach where applicable) and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.3 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.

.4 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.5 Do not apply paint until prepared surfaces have been accepted by the Contract Administrator.

3.5 APPLICATION

.1 Method of application to be as approved by Contract Administrator. Apply paint by brush roller air sprayer airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Contract Administrator.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Contract Administrator.

.4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.

.4 Paint fire protection piping red.

.5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

.1 Field inspection of exterior painting operations to be carried out be independent inspection firm as designated by Contract Administrator.

.2 Advise Contract Administrator when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to areas of work.

3.8 RESTORATION

.1 Clean and re-install all hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Contract Administrator. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Material and installation of site applied paint finishes to new interior surfaces, including site painting of shop primed surfaces.

.2 Related Sections:

.1 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2004.

.5 National Fire Code of Canada - 1995

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34 .

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.

.2 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

.2 Pre-Installation Meeting

.1 Convene pre-installation meeting one week prior to beginning work of this Section.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.4 SCHEDULING

.1 Submit work schedule for various stages of painting to Contract Administrator for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Contract Administrator for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets.

.3 Samples

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 13 mm birch plywood for finishes over wood surfaces.

.3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

.4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.5 10 mm cedar, hardboard, plywood for finishes over wood surfaces.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

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

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

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

.6 Manufacturer's Instructions:

.1 Submit manufacturer's installation and application instructions.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals .

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.8 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Coordinate use of existing ventilation system with Contract Administrator and ensure its operation during and after application of paint as required.

.3 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.4 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Contract Administrator and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85 % or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Contract Administrator such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

2.2 COLOURS

.1 Selection of colours from manufacturers full range of colours.

.2 Where specific products are available in restricted range of colours, selection based on limited range.

.3 Paint colours as selected by Contract Administrator.

.4 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Contract Administrator for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes inaccordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated and as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete:

.1 Premier, three coat system.

.2 As indicated on drawings.

.2 Structural steel and metal fabrications: columns, beams, joists:

.1 INT 5.1A - Quick dry enamel semi-gloss finish.

.3 Steel - high heat: pipes, flues, stacks, etc., with temperature range as noted:

.1 INT 5.2B - Heat resist ant aluminum paint finish, maximum 427 degrees C.

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 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Contract Administrator damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Concrete: 12 %.

.2 Clay and Concrete Block/Brick: 12 %.

.3 Wood: 15%

.4 Stucco, plaster and gypsum board: 12%.

3.4 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Contract Administrator.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants and general public in and about the building.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Contract Administrator.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Contract Administrator.

3.5 APPLICATION

.1 Method of application to be as approved by Contract Administrator. Apply paint by brush roller air sprayer airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish inside of cupboards and cabinets as specified for outside surfaces.

.10 Finish closets and alcoves as specified for adjoining rooms.

.11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Generator, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red .

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow .

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 FIELD QUALITY CONTROL

.1 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees degrés to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.2 Field inspection of painting operations to be carried out be independent inspection firm as designated by Contract Administrator.

.3 Advise Contract Administrator when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.4 Cooperate with inspection firm and provide access to areas of work.

.5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Contract Administrator.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Contract Administrator. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

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

.1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

.2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-2003, Mineral Fiber Pipe Insulation.

.7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-03a, 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)

.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 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): National Insulation Standards (Revised 2004).

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings

.4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 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 specified.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 013300 Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 013300 Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.3 Shop Drawings:

.1 Submit shop drawings in accordance with City of Winnipeg CW 1110 – General Instructions.

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: 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, member of TIAC.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 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 specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702, ASTM C547.

.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702, ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702, ASTM C547.

.5 TIAC Code C-2: mineral fibre blanket faced with without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702 ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.

2.3 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.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

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 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m^2.

2.8 JACKETS

.1 Aluminum:

.1 To ASTM B209.
.2 Thickness: 0.50 mm sheet.
.3 Finish: smooth stucco embossed corrugated.
.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 Stainless steel:

.1 Type: 304.
.2 Thickness: 0.25 mm.
.3 Finish: smooth.
.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.

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 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers 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 Install hangers, supports outside vapour retarder jacket.

.5 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 expansion joints, valves, flanges and 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: aluminum SS PVC high temperature fabric.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements:

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C

.3 TIAC Code: A-2.

.1 Insulation securements:

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-H

.4 Thickness of insulation 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.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)
			All
Diesel generator exhaust system		C-2	38

.5 Finishes:

.1 Exposed indoors: aluminum jacket.

.2 Exposed in mechanical rooms: aluminum jacket.

.3 Finish attachments: SS bands, at 150 mm on centre. Seals: wing or closed.

.4 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.6 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing specialties and accessories.

.2 Related Sections:

.1 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

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

.1 ASTM A126-95(2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA).

.1 AWWA C700-02, Cold Water Meters-Displacement Type, Bronze Main Case.

.2 AWWA C701-02, Cold Water Meters-Turbine Type for Customer Service.

.3 AWWA C702-1-01, Cold Water Meters-Compound Type.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.

.2 CSA-B79-94(R2000), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.

.3 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.

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

.1 Material Safety Data Sheets (MSDS).

.5 Plumbing and Drainage Institute (PDI).

.1 PDI-G101-96, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.

.2 PDI-WH201-92, Water Hammer Arresters Standard.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details and accessories for following: soap dispensing system .

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals , include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with manufacturer’s instructions.

Part 2 Products

2.1 MATERIALS

2.2 FLOOR DRAINS

.1 Floor Drains and Trench Drains: to CSA B79.

.2 Type 2: heavy duty ; cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan and clamping collar.

2.3 ROOF DRAINS

.1 Type 2: standard roof drain with cast iron body with aluminum or cast iron dome, under-deck clamp to suit roof construction, flashing clamp ring with integral gravel stop.

.2 Type 4: parapet or scupper drain ; cast iron body with bronze aluminum strainer/grate and flashing clamp.

.3 Type 5: inverted roofing system ; cast iron body with aluminum or cast iron dome, under-deck clamp and sump receiver to suit roof construction, with integral gravel stop and stainless steel drainage grid.

2.4 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Floor Access: rectangular round cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron nickel bronze round or square, gasket, vandal-proof screws.

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 National Plumbing Code of Canada provincial codes, and local authority having jurisdiction or

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.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 NPS4.

3.4 TESTING AND ADJUSTING

.1 Floor drains:

- .1 Verify operation of trap seal primer.
- .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
- .3 Check operations of flushing features.
- .4 Check security, accessibility, removeability of strainer.
- .5 Clean out baskets.

.2 Roof drains:

- .1 Check location at low points in roof.
- .2 Check security, removeability of dome.
- .3 Adjust weirs to suit actual roof slopes, meet requirements of design.
- .4 Clean out sumps.
- .5 Verify provisions for movement of roof systems.

.3 Cleanouts:

- .1 Verify covers are gas-tight, secure, yet readily removable.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for large sewer valves and operators.

.2 Related Sections:

.1 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

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

.1 ASTM A126-95(2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 American Water Works Association (AWWA).

.1 C111/A21.11-07: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

.2

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details and accessories.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals , include:

.1 Description of valves and parts, giving manufacturers name, type, model, year.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with manufacturer’s instructions.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling.

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

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Adminstrator .

.5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIALS

2.2 Replacement Valves

.1 Eccentric Plug Valve

.1 Plug valves shall be of the non-lubricating, eccentric type and shall be designed for a working pressure of 150 psi. Valves shall provide tight shut-off at rated pressure.

.2 Minimum port area for all valves shall be 80% of corresponding pipe area.

.3 The plug valve body shall be cast iron ASTM A126 Class B with welded-in overlay of 90% nickel alloy content on all surfaces contacting the face of the plug. Sprayed, plated, nickel welded rings or seats screwed into the body are not acceptable.

.4 The valve plug shall be cast iron ASTM A126 Class B, with Buna N resilient seating surface to mate with the body seat.

.5 Valve flanges shall be in strict accordance with ANSI B16.1, Class 125.

.6 Plug valve shall be furnished with permanently lubricated sleeve type bearings conforming to AWWA C504. Bearings shall be of sintered, oil impregnated type 316 stainless steel ASTM A-743 Grade CF-8M or bronze ASTM B-127.

.7 Valves shaft seals shall be of the “U” cup type, in accordance with AWWA C504. Seals shall be self adjusting and repackable without moving the bonnet from the valve.

.8 Acceptable product: Pratt or approved equal in accordance with B6.

2.3 Valve Actuator

Cylinder actuator for valve shall be supplied with a compound link and lever arrangement designed to minimize water hammer.

.1 Each unit shall comply to AWWA C-540 Standard for Power Actuating Devices.

.2 All wetted parts of the cylinder shall be nonmetallic, except the cylinder rod which shall be chromium plated stainless steel. The rod seals shall be of the nonadjustable, wear compensating type. A rod wiper for removing deposits inside the cylinder shall be provided in addition to an external dirt wiper.

.3 Actuator to provide open and close functions (non-modulating)

.4 Actuator to include end limit switches.

.5 Actuator to be supplied with manual override.

.6 Actuator to be sized to provide required force based on 90 psig compressed air supply.

.7 Acceptable product: Pratt MDT with Dura-Cyl power cylinder or approved equal in accordance with B6..

.

2.4 Valve Repairs

.1 Knife Gate Valve Repairs

.1 Seats to be replaced with nitrile (Buna-N, Hycar, NBR) resilient seat rated for minimum 1.0 MPa (150 psig) non-shock cold water & sewer service.

.2 Packings to be reinforced Teflon (PTFE) type material.

.2 Bolt Replacements

.1 Replace specified bolts with equal size and configuration.

.2 Fasteners to be in conformance with AWWA C-111

.3 Material to be 304 Stainless Steel

.3 Gaskets

.1 Replace all flange gaskets in kind, with material approved for the application.

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 manufacturer's instructions and as specified.

3.3 TESTING AND ADJUSTING

.1 Test valves to the manufacturer’s rated operating pressure, but not to exceed 150 psig.

.2 Test that valves open and close smoothly under operating pressure conditions.

.3 Provide testing plan indicating test procedures and acceptable results.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 84 00 - Firestopping.

.2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 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.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 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. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.5 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible and as indicated.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as indicated.

.14 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless otherwise indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use gate valves at branch take-offs for isolating purposes except where otherwise specified.

.7 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.15 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.

.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.6 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.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 and below grade floors: Fire retardant, waterproof non-hardening mastic.

.2 Elsewhere: Provide space for firestopping. 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.

3.7 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.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 firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.8 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.9 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Contract Administrator 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 23.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Division 23.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Contract Administrator.

.6 Pay costs for repairs or replacement, retesting, and making good. Contract Administrator to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Contract Administrator.

3.10 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Contract Administrator.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 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 22 and 23. Refer to Division 26 for quality of materials and workmanship.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 013300 Submittal Procedures.

.2 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 GENERAL

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 373 W/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 373 W/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, 3 phase, 575 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Contract Administrator 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 7.5 kW/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 7.5 kW/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.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

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.

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 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1-1998, Power Piping.

.2 ANSI/ASME B31.3-2000, Process Piping Addenda A.

.3 ANSI/ASME B31.3-2001, Process Piping Addenda B.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206-97, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1-2000, Recommended Practices for Resistance Welding.

.2 AWS Z49.1-1999, Safety Welding, Cutting and Allied Process.

.3 AWS W1-2000, Welding Inspection Handbook..

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.

.5 Canadian Standards Association (CSA International)

.1 CSA W47.2-M1987(R1998), Certification of Companies for Fusion Welding of Aluminum.

.2 CSA W48 series-01, Filler Metals and Allied Materials for Metal Arc Welding.

.3 CSA B51-97, Boiler, Pressure Vessel and Pressure Piping Code.

.4 CSA-W117.2-01, Safety in Welding, Cutting and Allied Processes.

.5 CSA W178.1-02, Certification of Welding Inspection Organizations.

.6 CSA W178.2-01, Certification of Welding Inspectors.

1.2 QUALIFICATIONS

.1 Welders

.1 Welding qualifications in accordance with CSA B51.

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

.3 Furnish welder's qualifications to Contract Administrator.

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

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors

.1 Inspectors qualified to CSA W178.2.

1.3 QUALITY ASSURANCE

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

.2 Copy of welding procedures available for inspection.

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

Part 2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 WORKMANSHIP

.1 Welding: in accordance with ANSI/ASME B31.1 B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Division 23 applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Contract Administrator.

.2 Formulate "Inspection and Test Plan" in co-operation with Contract Administrator.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

3.4 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.5 REPAIR OF WELDS WHICH FAILED TESTS

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1-04, Power Piping.

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

.1 ASTM A125-1996(R2001), Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

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

.1 Material Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.3 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 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers, to withstand seismic events.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 013300 - Submittal Procedures.

.2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed FM approved to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved to MSS SP69.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed FM approved.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plateUL listed FM approved to MSS SP69.

.5 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies: in accordance with requirements of ASME B31.1 and MSS-SP-58.

.2 Steel brackets: in accordance with requirements of ASME B31.1 and MSS-SP-58.

.6 Hanger rods: threaded rod material to MSS SP58:

.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.

.7 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel.

.2 Use insulation shields for hot pipework.

.3 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework – galvanized.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, galvanized carbon steel to comply with MSS SP69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.9 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrications.

2.10 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.11 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 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 Install in accordance with:

.1 manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 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.

.7 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: to Canadian Plumbing Code, Provincial Code, authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.6 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

.7 Pipework greater than NPS 12: 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 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 degrees 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.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1-05, 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.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

1.3 SUBMITTALS

.1 Product Data:

.2 Submittals: in accordance with Section 013300 - Submittal Procedures.

.3 Product data to include paint colour chips, other products specified in this section.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

.2 Dispose of unused paint coating material at official hazardous material collections site approved by Contract Administrator.

.3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 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.

2.2 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 white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	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 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: size #9.

.2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.3 Equipment elsewhere: sizes as appropriate.

2.3 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 Contract Administrator.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1 authority having jurisdiction.
.2 Propane gas: to CSA/CGA B149.1 authority having jurisdiction.
.3 Sprinklers: to NFPA 13.
.4 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), 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 Other pipes: pressure sensitive plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of

100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Contract Administrator.

.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**
Raw water	Green	RAW WATER
City water	Green	CITY WATER
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Natural gas	to Codes	
Gas regulator vents	to Codes	
Compressed air (<700kPa)	Green	COMP. AIR kPa
Compressed air (>700kPa)	Yellow	COMP. AIR kPa
Fire protection water	Red	FIRE PROT. WTR

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

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 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.

2.9 LANGUAGE

.1 Identification 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 specified Section 09 91 23 - Interior 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 Identify systems, equipment to conform to PWGSC PMSS.

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 17 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, confined spaces, at entry and exit points, and at access openings.

.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, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification 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 Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Contract Administrator.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contract Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.9 START OF TAB

.1 Notify Contract Administrator 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Laboratory HVAC systems: plus 10 %, minus 0 %.

.2 Other HVAC systems: plus 5 %, minus 5 %.

.3 Hydronic systems: plus or minus 10 %.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Contract Administrator list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Contract Administrator.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Contract Administrator prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.
.2 System schematics.

.3 Submit 6 copies of TAB Report to Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Contract Administrator.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Contract Administrator.

.4 Pay costs to repeat TAB as required to satisfaction of Contract Administrator.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of AABC NEBB SMACNA ASHRAE.

.2 Do TAB of all new exhaust and supply air systems.

.3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified by to standards of AABC or NEBB.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter summer design conditions at all times.

.3 Zone pressure differences:

.1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.

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 REFERENCES

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

.1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.3 GASEOUS FUEL SYSTEMS

.1 Operation tests:

.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.

1.4 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in Division 23.

.2 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 recharge air chambers. 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.

1.5 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

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 SUMMARY

.1 Section Includes:

.1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCES

.1 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 013300 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 CLEANING SOLUTIONS

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

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 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation procedures for electric heating and ventilation controls.

.2 General Description and Sequence of Operations

.2 General Scope and Related Work

.1 All Work required by these Controls Specifications, Schedules, Point Lists and Drawings shall be coordinated and provided by the single Contractor referenced in these Specifications as the Controls Contractor.

.2 If the Controls Contractor believes there are conflicts or missing information in the Contract Documents then the Contractor shall promptly request clarification and instruction from the Contract Administrator before proceeding.

.3 The Controls Contractor shall have visited the Project site and obtained information as necessary prior to submittal of the bid to ensure that prevailing physical conditions and Project arrangements that may be material to the performance of the Work have been ascertained and accommodated in the bid. No claims for additional payments will be accepted due to the Contractor's failure to complete this survey.

.4 If, in order to complete the Work of the Controls Contract, private and/or public telephone lines and connections, including ISDN lines and/or LAN/WAN support and connections, are required then these shall be provided by the City to the Controls Contractor, at the City's direct cost, in a timely manner.

.5 The City has an existing central monitoring system in place. Where DDC points are identified as centrally monitored points, controls contractor shall provide and install required hardware and software to interface to the City's Digital Control System.

1.2 REFERENCES

.1 Application Acts, Regulations, Codes and Standards

.1 The following Acts, Codes, Regulations and Standards apply to the design installation and/or operation of Ventilation Systems at Hydro One Remote Community Diesel Generating Stations.

.1 CSA 22.1 Canadian Electrical Code

.2 National Building Code of Canada

.3 National Fire Code of Canada

.2 Works

.1 The Controls Contractor's work shall consist of the provision of all labor, materials, special tools, equipment, enclosures, power supplies, interfaces, wiring, tubing, installation, labeling, calibration, documentation, submittals,

testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and items required by the Contract that are required for the functional turn-key operation of the complete and fully functional Controls Systems.

.2 Provide a complete, neat and workmanlike installation. Use only employees who are qualified, skilled, experienced, manufacturer trained and familiar with the specific equipment, software and configurations to be provided for this Project.

.3 The Controls Contractor shall employ qualified and experienced Controls Systems, Software, Application Design, Installation and Project Supervision personnel to provide the specific solutions required to meet the Project requirements and who are available to undertake this work as scheduled.

.4 Manage and coordinate the Controls Systems work in a timely manner in consideration of the Project master schedules. Coordinate cooperatively with the associated work of the other trades so as to assist the progress and not impede or delay the work of associated trades.

.5 Controls Systems as provided shall incorporate, at minimum, the following integral features, functions and services:

.1 Interfaces between individual elements and the systems and networks provided by the City and other trades as required by the Contract Documents.

.2 All other Controls Systems functions as required by the Contract Documents.

.6 The Controls System as provided shall comprise, at a minimum, the following primary elements:

.1 Field Devices.

.2 Control wiring.

1.3 QUALITY ASSURANCE

.1 General Requirements:

.1 All devices shall be CSA certified and UL or FM listed and labeled for the specific use, application and environment to which they are applied.

.2 All electronic equipment shall conform to the requirements of FCC regulations, part 15, section 15, governing radio frequency electromagnetic interference, and be so labeled.

.2 Workplace Safety And Materials Management

.1 Provide a safety program in compliance with the Contract Documents.

.2 The Controls Contractor shall have a comprehensive Safety Manual and a designated Safety Supervisor for the Project.

.3 The Contractor and its employees and sub trades shall comply with Federal, Provincial and local safety regulations.

.4 The Contractor shall ensure that all subcontractors and employees have written safety programs in place that cover their scope of work.

.5 Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.

.6 Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the City within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Provide at minimum the following basic submittals:

.1 Individual System Schematics including sequences of operation.

.2 Complete Bill of Materials.

.3 Damper Schedules.

.4 Descriptions and/or product data sheets for all equipment, materials, software, firmware components and items to be furnished and provided. Information shall be Project specific and not general advertising.

.2 Operation and Maintenance Manuals

.1 At the completion of the project the Controls Contractor shall submit three sets of as-built documentation for the City's Operation and Maintenance Manuals which shall include the following as a minimum:

.1 Name and address of installing contractor along with 24-hour emergency service telephone number.

.2 As-built version of Shop Drawings.

.3 Licenses, Guarantees and warranty documents for all equipment and systems.

1.5 WARRANTY

.1 Standard Material and Labor Warranty:

.1 Provide a one-year labor and material Warranty on Controls Contract work provided under this Contract.

.2 If within twelve (12) months from the date of acceptance of the Controls Contract work and following receipt of written notice from the City the product is found to be defective in operation, workmanship or materials, then the product shall be promptly replaced, repaired or adjusted at the option of the Controls Contractor at the cost of the Controls Contractor.

.3 Maintain an adequate supply of materials available directly to the Project site such that replacement of key parts, including programming, may be promptly carried out. Warranty work shall be done during the Controls Contractor's normal business hours.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

Part 2 Materials

2.1 DAMPERS

.1 Refer to appropriate section.

2.2 DAMPER OPERATORS

.1 Damper operators shall be electric and be provided for each automatic damper and shall be of sufficient capacity to operate the damper under all conditions as specified.

.2 Damper operators shall be direct drive and equal to those manufactured by Belimo. Provide sufficient quantity of damper operators to provide a minimum of 5 in-lbs of torque for every square foot of damper area.

.3 Each central system damper shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as indicated or as appropriate.

2.3 DIFFERENTIAL PRESSURE SENSORS

.1 Refer to Section 29 50 01.

2.4 GAS DETECTION DEVICES

.1 Refer to Section29 50 01.

2.5 AIR FLOW PROVING SWITCHES

.1 Low differential pressure switch, rated for Class 1, Division II sensing. Full load: 15A at 120V. Maximum ambient temperature: 82 degrees C (180 degrees F.). Operating range: 17 to 54 Pa (0.07 to 0.22" W.C.).

.2 Acceptable Products: Dwyer 1950 G series.

2.6 THERMOSTAT (LINE VOLTAGE, HEATING)

.1 Line voltage wall mounted integral electric heating thermostat with:

.1 Full load rating: 22A at 120V.
.2 Temperature setting range: 5 degrees C to 30 degrees C.
.3 Double pole.
.4 Thermometer range: 5 degrees C to 30 degrees C.
.5 Scale markings: Off-5-10-15-20-25 degrees C.

.2 Acceptable Products: Johnson Controls T26 series, or approved equal in accordance with B6.

2.7 TEMPERATURE SENSING DEVICES

.1 Refer to Section 29 50 01.

.2 Duct Type Temperature Transmitter shall be a general purpose RTD sensing element, moisture resistant transmitter for mounting into a duct. The operating range shall be as indicated with an accuracy of + 1% over the full range. The output shall be compatible with the panel it serves.

.3 Duct Averaging Type Temperature Transmitter shall be a general purpose RTD sensing element, moisture resistant transmitter for mounting into a duct. The operating range shall be as indicated with an accuracy of + 1% over the full range. The output shall be compatible with the panel it serves. The sensing element shall be of sufficient length to provide a minimum of one (1) foot of element for every two (2) square feet of coil area.

.4 Space Temperature Transmitter: Refer to Section 29 50 01.

.5 Low Limit Thermostats shall be of manual reset type, with setpoint adjustment. The sensing element shall be of sufficient length to provide a minimum of one (1) foot of element for every two (2) square feet of coil area. The element shall run fully across the coil on each pass. When any one foot of the element senses a temperature as low as the setpoint, the thermostat contacts shall open. These shall contain double pole switches for simultaneous remote alarms or as desired.

.6 Acceptable Products: Johnson Controls TE series.

Part 3 Execution

3.1 HVAC System Operation

.1 The new ventilation system for the Perimeter Road Pumping Station will operate as described in the following sections.

.2 The document is divided according to the main building systems or areas. A general description is provided for each, followed by a sequence of operation which is subdivided by the type of control inputs.

.3 All input and output signals external to the devices mentioned herein will be from/to the City's existing Digital Control System (DCS), which will be programmed accordingly by the City.

3.2 NEW MAKE UP AIR UNIT (M609-AHU)

.1 General Description

.1 The new unit will provide tempered air into the Dry Well and main open area of L400. Area distribution will be controlled by VAV units.

.2 The MUA unit will:

.1 Be indirect fired natural gas heated

.2 Have a variable flow rate from approximately 1750LPS to 3920LPS (3,600 CFM to 8,000 CFM).

.3 Have a modulating burner

.4 Provide a maximum 27C (80F) temperature rise at maximum flow rate.

.5 Modulate discharge air temperature based on building management 0-10VDC signal.

.2 Sequence of Operation

.1 Upon signal from DCS to start

.1 The unit's main inlet damper will open.

.2 The unit will operate continuously at minimum speed, providing approximately 1750LPS (3,600 CFM) into the building.

.3 When outdoor temperature is below 10C (50F), the burner will modulate to provide a discharge air temperature of approximately 15C (60F)

.4 The DCS will provide a signal to increase airflow and temperature in response to inputs for heating or for additional ventilation from various locations as listed below.

.5 A pressure sensor in the discharge of M609-AHU, provided by AHU manufacturer will provide internal signal to the unit's integral VFD to maintain constant discharge plenum pressure regardless of VAV position.

3.3 DRY WELL VENTILATION (L100,200,300):

.1 General Description

.1 The Dry Well is physically separated from the Wet Well and will be electrically unclassified by the use of pressurization. (2003 NPFA 820, Table 4.2 Row 17D, and 9.2.4, and NFPA 496 , 7.4.1), thus not requiring exhaust fans.

.2 Existing M606-MAF (also identified as F6), which provides both combustion and cooling air for the engine on L300 will now also provide room cooling air flow if called for by ambient Dry Well temperature even if engine is not running.

.3 L300 of the Dry Well will be monitored for flammable and explosive gases.

.4 The differential pressure between the Dry Well and Wet Well will be monitored on Level 300.

.5 The differential pressurization of 25Pa (0.1"w.c.) relative to the Wet Well, and a minimum 60 fpm through any open door(s) will be achieved by the AHU and modulation of main relief damper M632-MD.

.6 The AHU will provide up to 6 ach (air changes per hour), approximately 3000 LPS (6300 cfm) to these levels. This will meet NFPA 820 requirements for 6 ach if the pressure falls below 25Pa, or if any explosive gases exceed 10% of the LEL/LFL. Airflow to level 300 will also be increased if temperature exceeds 25C.

.2 Sequence of Operation

.1 Differential Pressure:

.1 Differential pressure detectors M613-DPT continuously monitors differential pressure on L300.

.2 If M613-DPTs senses differential pressure less than 25Pa, (0.1"W.C.) it will send a signal to the DCS.

.3 The DCS will either reduce opening of M632-MD if the air volume is over 1 ACH, and not required for gas or temperature controls, or will increase the VAV airflow, until the differential pressure reaches 25Pa (0.1"W.C.), or to a maximum of 6 ACH for those level(s).

.4 If differential pressure at M613-DPT exceeds 30Pa in any of the 3 levels, at the required air flow volume, the DCS will signal Damper M632-MD- to open further to allow relief venting.

.5

.2 Gas Detection:

.1 Gas Detectors M932-GD monitors level 300 for accumulation of natural gas.

.2 Upon reaching 10% of the LEL, a signal will be sent to the DCS to increase ventilation to that level.

.3 The DCS will signal the VAV for the appropriate level(s) to increase flow to 6 ACH until the gas level drops to below 10% of the LEL.

.3 Airflow Control:

.1 The DCS will send a signal to VAV for L300, or VAV for L200 & L100, to increase air flow until 25 Pa (0.1"W.C.) differential pressure is achieved.

.2 A flow sensor in each of the VAVs will monitor airflow and provide a signal to the DCS. The DCS will control the VAV to provide a maximum of 6 air changes per hour (ACH) for the space it supplies.

.3

.4 Temperature Control

.1 A temperature sensor on L300 (M619-TT) will provide a signal to the DCS if room temperature exceeds 25C (77F).

.2 The DCS will signal M616-VAV to increase airflow to L300 to provide additional ventilation to cool the space. If space temperature reaches 28C (80F), the DCS will send a signal to start existing fan M606-MAF, which will run at full speed.

.3 As the temperature drops to below 25C (77F), the DCS will provide a signal to M616-VAV to reduce airflow from M609-AHU.

.4 Upon attaining 20C (68F), M606-MAF will turn off, and M616-VAV will provide the minimum set airflow.

.5 L200 and L100 will not be monitored for temperature.

3.4 SUPERSTRUCTURE (L400)

.1 General Description:

.1 The main floor will be physically separated from the Wet Well.

.2 The inside stair case to lower levels will be enclosed at the top level with a vestibule and door, thus separating the Superstructure from the Drywell.

.3 The existing control room, will use its existing dedicated air handling unit to provide existing levels of pressurization. This unit will receive standby power.

.4 The room housing the new generator will be treated separately.

.5 The remaining areas of L400 are not classified electrically. These main areas will normally receive 1 ACH from the AHU. If the space temperature varies

from the specified minimum and maximums, airflow to these areas will increase to provide more heated air, or more outside air to cool the room. A supplementary wall supply air fan will provide additional cooling air when required.

.2 Sequence of Operation:

.1 Temperature - Heating

.1 Regardless of L400 temperature, priority will be given to providing necessary air flow to maintain Dry Well pressure, or to evacuate any Dry Well gas detected by the monitors.

.2 Gravity back draft damper M633-DP provides relief from L400. It is adjusted to open with 25Pa at approximately 560 LPS (1200 CFM).

.3 Room sensor M618-TT monitors L400 temperature and provides a signal to the DCS

.4 If room temperature drops below 10C (50F), the DCS will send a signal to the AHU to provide heat.

.5 If the room temperature setting is not achieved, the DCS will send a signal to M615-VAV to gradually increase the airflow into L400, from 1 ACH to a maximum of 6 ACH for heating requirements.

.2 Temperature - Cooling

.1 If room temperature increases above 25C (77F), the DCS will send a signal to M615-VAV to gradually increase air flow into L400.

.2 Airflow to L400 will increase as required to provide cooling provided Dry Well differential pressure is not compromised and Dry Well flammable gas levels remain at less than 10% of LEL/LFL.

.3 If room temperature increases above 28C (83F), the DCS will send a signal to west wall supply air fan M6xx-EF to provide additional air directly from outside. Air will exhaust via gravity damper M633-DP. Fan will stop upon reaching 25C(77F).

3.5 NEW EXTERIOR STAIRCASE(S)

1. The new east side staircase will not be mechanically ventilated. Some leakage from the pressurized Dry Well is anticipated.

2. Electric baseboard heaters with line thermostats will be installed to allow heating as required..

3.6 STANDBY GENERATOR AND ROOM

.1 General Description

.1 Ventilation air into the room will normally be brought in by the two existing electrically heated air handling units. Room temperature will normally be 20C (68F).

.2 When the generator is operating, combustion and room cooling air, controlled by damper M621-MD, M625-MD, will be brought in through an outside air duct through the new Wet Well staircase.

.3 Airflow from the radiator fan will discharge into a shroud and duct which will either recirculate the air in the room, or discharge it to the outside.

.2 Sequence of Operation:

.1 Generator Start-Up

.1 Recirculation damper M624-MD is normally open.

.2 Upon power failure or start signal from the DCS the electrically closed, spring opened outside air damper M625-MD opens to provide combustion air.

.3 The generator starts.

.4 The generator radiator fan starts

.5 Radiator discharge air damper M623-MD remains closed.

.6 Outside air damper M621-MD remains closed.

.7 Air recirculates through radiator core and back to generator end of engine.

.2 Temperature

.1 Temperature sensor M625-TT provides a signal to the DCS.

.2 If room temperature reaches 21C (70F), DCS signals outside air supply damper M621-MD to open fully to allow entry of room cooling air.

.3 DCS signals discharge damper M623-MD to open partially, and M624-MD to close partially.

.4 M623-MD will continue to open gradually as required to maintain 21C (70F)

.5 M624-MD will continue to close sequentially with M623-MD opening.

.6 If room temperature reaches 25C (77F) the DCS will send a signal to exhaust damper M622-MD to open fully and exhaust fan M620-EF to start.

.7 Exhaust fan M620-EF will operate at 33% of maximum speed.

.8 If temperature continues to increase, M620-EF will continue to increase speed to maintain room temperature of 25C (77F)

3.7 WET WELL

.1 General Description

.1 Physically separated from the Dry Well and SuperStructure.

.2 The Wet Well will be classified as Class 1, Div.1 status, and will not require any code mandated ventilation, as per 2003 NFPA 820 Table 4.2, Row 16, Line a.

.3 The City has requested an exhaust fan. It will be installed on the existing roof platform in the small penthouse and will have standby power. It will run continuously at 3 air changes per hour (ACH).

.4 Exhaust air flow, and gas detection will be monitored by the DCS.

.5 The 3 Wet Well levels will be monitored for flammable and explosive gases, and Hydrogen Sulphide. If 10% of the LEL/LFL is reached, the presence of H2SO4 gas is detected, or if manually selected for confined space entry, the DCS will alarm and the exhaust will provide 12 ACH , equivalent to approximately 1750 litres per second (LPS) or 3600 Cubic Feet per Minute (CFM).

.6 Fresh air will be brought in directly from the outdoors via dedicated ducting. The air will not be heated.

.2 Sequence of Operation

.1 The DCS provides an on/off signal for EF1

.2 Flow Switch M6-FS provides a signal to the DCS confirming exhaust air flow.

.3 DCS will indicate alarm if no flow is detected.

.4 A manual selector switch (at Wet Well staircase entry) will signal the DCS to provide full exhaust airflow for personnel entry into the space.

.5 Temperature sensor M6xy-TT monitors L300 temperature in the Wet Well

.6 M610-EF VFD provides 1/6 of maximum speed and airflow

.7 M910-GD, M911-GD, M920-GD, M921-GD, and M930-GD, M931-GD monitor respective levels of Wet Well for presence of flammable or Hydrogen Sulphide gas respectively.

.8 If the 10% level is read at any detector, or if Hydrogen Sulphide gas is detected, a signal is sent to the DCS.

.9 DCS displays alarm signal.

.10 DCS provides a signal to M610-EF1's VFD to ramp up to maximum rpm and air flow

.11 If temperature drops to less than 4C (39F) the DCS will show a low temperature alarm.

3.8 INSTALLATION PRACTICES

.1 Controls Systems Wiring

.1 Install in accordance with Division 26 and 29.

.2 All conduit raceways, wiring, accessories and wiring connections required for the installation of the Controls Systems shall be provided by the Controls Contractor except as shown on the Electrical Trade documents. All wiring shall comply with the requirements of applicable portions of the Electrical Trade work and all local and national electric codes and the requirements of the AHJ.

.3 All Controls Systems wiring materials and installation methods shall comply with the original equipment manufacturer recommendations and standards.

.4 The sizing type and provision of cable, conduit, cable trays and raceways shall be the design responsibility of the Controls Contractor.

.5 Class 2 Wiring

.1 All Class 2 (30VAC or less) wiring shall be installed in conduit unless otherwise specified.

.2 Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5 ft. from the building structure. Wiring shall be installed parallel to the building structural lines.

.6 Class 2 signal wiring and 24VAC power may be run in the same conduit. Power wiring 120VAC and greater shall not share the same conduit with Class 2 signal wiring.

.2 Line Voltage Power Sources

.1 120-volt AC circuits for the Controls Systems shall be taken by the Controls Contractor from electrical trade panelboards and circuit breakers as designated on the electrical drawings.

.2 Circuits used for the Controls Systems shall be dedicated to these Controls Systems and shall not be used for any other services.

.3 Controllers for powered terminal units may use 120-volt AC power from motor power circuits.

.3 Controls Systems Raceways

.1 .1 All wiring shall be installed in conduit or raceway except as noted elsewhere in the Specification.

.2 .2 Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Contract Administrator.

.3 .3 All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the supporting surface.

.4 .4 UL/ULC Listed Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls and for final connection to equipment.

.4 Field Panel Installation And Location

.1 The Controls Systems panels, enclosures and cabinets shall be located as coordinated with the Architect at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.

.2 All field devices shall be installed per the manufacturer recommendation and in accessible locations as coordinated with the Architect.

.3 Panels to be located in damp areas or areas subject to condensation shall be mounted with wall standoffs.

.4 Conduit configurations entering or leaving panels and devices shall be such as to preclude condensation traps.

.5 Identification

.1 All control components and services shall be identified with appropriately sized lamecoid labels with a unique name/number referencing item back to the shop drawings and or maintenance manuals.

.2 All control wiring conduits shall be color-coded and identified so as to be distinguishable from standard electric conduiting.

.3 Clearly identify all controls LAN hubs and racks.

.4 All control wiring terminations shall be taqgged and referenced.

3.9 VERIFICATION

.1 Fully test and verify all aspects of the Controls Systems Contract work on a point/system/integrated operational basis for all points, features and functions specified.

.1 Test each digital output for proper results from the Operator Workstation.

.2 Test each analog output by sending commands from the Operators Workstation to stroke an actuator throughout its range.

.3 Test each digital input for proper verification at the Operators Workstation. Jumper digital alarm inputs as required.

.4 Calibrate all temperature, humidity and pressure sensors with a hand held digital meter with equal or better accuracy.

.5 All software programs shall be fully tested to eliminate any glitches and to ensure conformance with the specifications. A system shall be considered commissioned when all alarms and system values are appropriate for the control sequence defined. Submit history logs for approval.

.2 Provide all necessary specialist labor, materials and tools to demonstrate to the Contract Administrator that the Controls Systems have been verified and are operating in compliance with the Controls Systems Contract.

.3 Promptly rectify all deficiencies and submit in writing to the Architect a signed report that this has been done.

3.10 MANUFACTURER'S INSTRUCTIONS

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

3.11 INSTALLATION

.1 Install control devices.

.2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.12 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for piping, valves and fittings for gas fired equipment.

.2 Related Sections:

.1 Section 01 78 00 - Closeout Submittals.
.2 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.
.3 Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
.2 ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
.3 ASME B16.22-01, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
.4 ASME B18.2.1-96, Square and Hex Bolts and Screws Inch Series.

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

.1 ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A53/A53M-04, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
.3 ASTM B75M-99, Standard Specification for Seamless Copper Tube Metric.
.4 ASTM B837-01, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 Canadian Standards Association (CSA International)

.1 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

.1 CAN/CSA B149.1HB-00, Natural Gas and Propane Installation Code Handbook.
.2 CAN/CSA B149.2-00, Propane Storage and Handling Code.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Submittals in accordance with Section 013300-Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

.2 Indicate on manufacturers catalogue literature following: valves.

.3 Submit WHMIS MSDS in accordance with Section 02 61 33 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.3 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.

.2 NPS2 1/2 and over, plain end.

.2 Copper tube: to ASTM B837.

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Brazing: to ASTM B837.

2.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ASME B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ASME B16.18.

.2 Wrought copper fittings: to ASME B16.22.

2.4 VALVES

.1 Provincial Code approved, lubricated ball type.

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 CAN/CSA B149.1, CAN/CSA B149.2, supplemented as specified.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Contract Administrator.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system in accordance with CAN/CSA B149.1 CAN/CSA B149.2 and requirements of authorities having jurisdiction.

.2 Performance Verification:

.1 Refer to Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

3.5 ADJUSTING

.1 Purging: purge after pressure test in accordance with CAN/CSA B149.1 CAN/CSA B149.2.

.2 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.

3.6 CLEANING

.1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems CAN/CSA B149.1, CAN/CSA B149.2, supplemented as specified.

.2 Perform cleaning operations and in accordance with manufacturer's recommendations.

.3 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

.2 Related Sections:

.1 Section 02 61 33 - Hazardous Materials.

.2 Section 07 84 00 - Firestopping.

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 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-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-03, 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-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-01, 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, 2nd Edition 1995 and Addendum No. 1, 1997.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.

.3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

.7 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 013300 Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials for the following:

.1 Sealants.
.2 Tape.
.3 Proprietary Joints.

1.4 QUALITY ASSURANCE

.1 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.

.2 Indoor Air Quality (IAQ) Management Plan.

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 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 packaging material in appropriate on-site bins for recycling.
.3 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste.
.4 Place materials defined as hazardous or toxic in designated containers.
.5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
.6 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

.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 tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets sealant tape or combination thereof. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.

.1 Rectangular: standard radius.

.2 Round: five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single double thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct 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 Full radiused elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Firestopping.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE SMACNA.

.3 Joints: to ASHRAE SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

.4 Stainless steel included in electronic copy.

2.8 STAINLESS STEEL

.1 To ASTM A480/A480M, Type 304.

.2 Finish: No. 4.

.3 Thickness, fabrication and reinforcement: to ASHRAE SMACNA or as indicated.

.4 Joints: to ASHRAE and SMACNA or continuous inert gas welded were specified.

2.9 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.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.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6

Duct Size	Angle Size	Rod Size
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 steel plate washer.

.3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with NFPA 90A NFPA 90B ASHRAE SMACNA as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct Ensure diffuser is fully seated.

.3 Support risers in accordance with ASHRAE SMACNA as indicated.

.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 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Solder 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 32 mm drain connected, with deep seal trap and valve trap primer and discharging to open funnel drain as indicated.

3.4 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.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.

.2 Related Sections:

.1 Section 01 78 00 - Closeout Submittals.

.2 Section 02 61 33 - Hazardous Materials.

1.2 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.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 013300 - Submittal Procedures.

.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.

.2 Submit WHMIS MSDS in accordance with Section 02 61 33 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.3 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.66 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.

2.3 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 complete with safety chain.
.2 301 to 450 mm: four sash locks complete with safety chain.
.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.

2.4 TURNING VANES

.1 Factory or shop fabricated single thickness without trailing edge, to recommendations of SMACNA and as indicated.

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 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 viewing.

.3 As indicated.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 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 Contract Administrator.

.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 accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

.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. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Manufacturer’s Instructions.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Single thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

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 as indicated.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon 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 as indicated.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage : 5 % at 250 Pa.

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.

.7 Corrections and adjustments conducted by Contract Admnistrator.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

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

.1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.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 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.2 Indicate the following:

.1 Performance data.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed and or parallel blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: to Section 23 09 33 Electric and Electronic Control system for HVAC.

.6 Performance:

.1 Leakage: in closed position less than 2% of rated air flow at 250 Pa differential across damper.

.2 Pressure drop: at full open position less than 25 Pa differential across damper at 10 m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi, aluminum construction with nylon bearings, centre pivoted spring assisted or counterweighted, as indicated.

2.3 RELIEF DAMPERS

.1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open at 25 Pa static pressure.

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 manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Fire and smoke dampers, and fire stop flaps.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)ANSI/NFPA 90A-2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

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

.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S112-M1990, Fire Test of Fire Damper Assemblies.

.2 CAN4-S112.2-M84, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.3 SUBMITTALS

.1 Product Data:

.2 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 013300 - Submittal Procedures.

.1

.2 Indicate the following:

.1 Fire dampers.

.2 Smoke dampers.

.3 Fire stop flaps.

.4 Operators.

.5 Fusible links.

.6 Design details of break-away joints.

.3 Quality assurance submittals: submit following

.1 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual.

1.4 MAINTENANCE

.1 Extra Materials:

.1 Provide following:

.1 3 fusible links of each type.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type A listed and bear label of ULC, meet requirements of authorities having jurisdiction. Fire damper assemblies 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.

.3 Top hinged: offset ,square; multi-blade hinged 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 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.

.7 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.8 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.

.9 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

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 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 - Air Duct Accessories .

.5 Co-ordinate 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.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Roof and wall exhausters.

1.2 REFERENCES

.1 Air Movement and Control Association (AAMC)

.1 AMCA Publication 99-2003, Standards Handbook (Revised 2003).

.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)

.1 ANSI/AMCA 210-99, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

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

.1 Material Safety Data Sheets (MSDS).

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 in force. Provide confirmation of testing.

.2 Capacity: flow rate, total static pressure Pa, r/min, bhp W, model and size and sound ratings as indicated on schedule.

.2 Statically and dynamically balanced. Constructed to AMCA 99.

.3 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, unit to bear AMCA certified rating seal.

.5 Bearings: sealed lifetime ball bearings with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Include :

.1 Fan performance curves showing specified point of operation.

.2 Sound rating data.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with City of Winnipeg CW 1110 – General Instructions.

.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 VANE-AXIAL EXHAUSTER

.1 Vane-Axial V belt driven.

.1 Housings: 304 stainless steel complete with resilient mounted motor and fan.

.2 Impeller: spark proof.

.3 Adjustable motor sheave.

.4 12 mm mesh 2.0 mm diameter aluminum birdscreen.

.5 Vertical mounting lugs.

2.2 WALL EXHAUSTERS

.1 Propeller fan units, V belt driven.

.1 Galvanized steel housings, complete with resilient mounted motor and fan.

.2 12 mm mesh 2.0 mm diameter aluminum birdscreen.

.3 Cadmium plated securing bolts and screws.

.2 Housings:

.1 Provide with rubber or neoprene grommets for wiring passages, integral attachment collar, or angle ring mounted to mating flanged wall sleeve with full gasketting.

.2 Discharge pattern: away from building.

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 manufacturer's instructions.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Supply, return and exhaust grilles and 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 013300 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Pressure drop.

.4 Neck velocity.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

1.5 MAINTENANCE

.1 Extra Materials:

.1 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.3 Concealed manual volume control damper operators.

.4 Colour: standard.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

.1 As specified on drawings.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 As specified on 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 Install in accordance with manufacturers instructions.

.2 Install with flat head oval head cadmium plated screws in countersunk holes where fastenings are visible.

3.3 CLEANING

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

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 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

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

.1 ASTM E90-04, 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 013300 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 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 with approved caulking slot, integral to unit.

.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 Contract Administrator’s approval.

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 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.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)

.1 ANSI/NFPA 96- 1994 , Ventilation Control and Fire Protection of Commercial Cooking Operations .

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.1- 1992 , Gravimetric And Dust Spot for Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.10- M90 , Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.11- M85 , Filters, Air, High Efficiency, Disposable, Bag Type (Reaffirmed April 1985).

.3 CAN/CGSB-115.12- M85 , Filters, Air, Medium Efficiency, Disposable, Bag Type (Reaffirmed April 1985).

.4 CAN/CGSB-115.13- 85 , Filter Media, Automatic Roll (Reaffirmed April 1985).

.5 CAN/CGSB-115.14- M91 , High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.6 CAN/CGSB-115.15- M91 , High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.

.7 CAN/CGSB-115.16- M82 , Activated Carbon for Odor Removal from Ventilating Systems.

.8 CAN/CGSB-115.18- M85 , Filter, Air, Extended Area Panel Type, Medium Efficiency.

.9 CAN/CGSB-115.20- 95 , Polarized Media Air Filter.

.4 Underwriters= Laboratories of Canada

.1 ULC -S111- M80 , "Fire Tests for Air Filter Units".

.2 ULC-S649-1993, Grease Filters for Commercial and Institutional Kitchen Exhaust Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawing and product data in accordance with Section 013300- Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual.

1.4 MAINTENANCE MATERIALS

.1 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

1.5 EXTRA MATERIALS

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Contract Administrator, supply 1 complete set of filters for each filter unit or filter bank.

Part 2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50°C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated .

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

2.2 ACCESSORIES

.1 Holding frames: permanent channel section construction of galvanized steel 1.6 mm thick, except where specified otherwise.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side.

2.3 FIBROUS GLASS PANEL FILTERS

.1 Disposable fibrous glass media: to CAN/CGSB-115.10 with adhesive.

.2 Holding frame: 1.2 mm minimum thick galvanized steel with 3 mm diam hinged wire mesh screen.

.3 Performance: minimum average synthetic dust weight arrestance 70 % to ASHRAE 52.1 .

.4 Fire rated: to ULC -S111.

2.4 CARTRIDGE TYPE FILTERS, 80-85 % EFFICIENCY

.1 Media: deep pleated, disposable, high efficiency, to CAN/CGSB-115.14.

.2 Holding frame: galvanized steel with bracing.

.3 Media support: welded wire grid.

.4 Performance: average atmospheric dust spot efficiency 80-85 % to ASHRAE 52.1 .

.5 Fire rated: to ULC -S111.

2.5 FILTER GAUGES - DIAL TYPE

.1 Diaphragm actuated, direct reading.

.2 Range: 0 to 2 times initial pressure 0 to 250 Pa .

2.6 FILTER GAUGES - MANOMETER TYPE

.1 Inclined acrylic tube.

.2 Complete with levelling screws.

.3 Range: 0 to 2 times initial pressure 0 to 250 Pa .

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer=s recommendations and with adequate space for access, maintenance and replacement.

3.2 FILTER GAUGES

.1 Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for self-contained multizone and single zone, gas, electric, HVAC units.

.2 Related Sections:

.1 Section 02 61 33 - Hazardous Materials: Submission Requirements for WHMIS MSDS.

.2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Air Conditioning and Refrigeration Institute (ARI)

.1 ANSI/ARI 210/240-03, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.2 ARI 270-95, Sound Rating of Outdoor Unitary Equipment.

.2 ANSI/UL 1995 B-1998, Standard for Heating and Cooling Equipment.

.3 Canadian Standards Association (CSA International)

.1 CSA B52-99, Mechanical Refrigeration Code.

.2 CSA C22.1 HB-02, Canadian Electrical Code Handbook.

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

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association

.1 NFPA 90A-02, Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 013300 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for packaged rooftop HVAC units.

.3 Submit WHMIS MSDS in accordance with Section 02 61 33 - Hazardous Materials

.4 Shop Drawings:

.1 Submit shop drawings to indicate project layout and dimensions; indicate:

.1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.

.2 Piping, valves, fitting shipped loose showing final location in assembly.

.3 Control equipment shipped loose, showing final location in assembly.

.4 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

.5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.

.6 Pump and fan performance curves.

.7 Details of vibration isolation.

.8 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual.

.1 Indicate: brief description of unit, indexed, with details of function, operation, control, and service for components.

.2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

1.4 WARRANTY

.1 For Work of this Section 23 74 00 Packaged Outdoor HVAC Equipment, 12 months warranty period prescribed is extended to 24 months.

Part 2 Products

2.1 GENERAL

.1 Self-contained single zone unit with gas burner and bear label of CSA, CGA, FM, UL and ULC.

.2 Units to consist of cabinet and frame, supply fan, heat exchanger, burner with integral induced draft fan, heater control, air filter, motorized outside air damper, return damper.

.3 Conform to ANSI/ARI 210/240, rating for unit larger than 40 kW nominal.

2.2 CABINET

.1 Cabinets: weatherproofing tested and certified to AGA rain test standards and soundproofing tested to ARI 270.

.2 Framing and supports: 2 mm thick welded steel, galvanized after manufacture, with lifting lugs at top of unit.

.3 Outer casing: weathertight 1.0 mm thick galvanized steel with baked enamel finish, complete with flashing.

.4 Access: gasketted hinged doors with quick locking door handle type fasteners.

.5 Insulation: neoprene coated glass fiber on surfaces where conditioned air is handled, 50 mm thick, 32 kg/m^3density.

2.3 FANS

.1 Centrifugal, forward curved impellers, statically and dynamically balanced. Multi V-belt drive with adjustable variable pitch motor pulley, spring isolated hinge mounted motor fan and motor integrally mounted on isolation base, separated from unit casing with flexible connections and spring isolators. Vibration isolators: 95 % efficiency.

2.4 AIR FILTERS

.1 50 mm thick, 85% efficiency, metal framed, replaceable media throwaway, standard to unit manufacturer.

.2 To meet NFPA 90A, air filter requirements type Class 2.

2.5 HEAT EXCHANGERS AND BURNERS

.1 Gas fired, multiple flue passes, with primary heating surface of stainless steel ; secondary heating surface, stainless steel tubes.

.1 Gas burner: factory mounted, wired and fire tested complete with operating and safety controls.

.2 Forced continuous port steel multi-slotted non-clogging cast iron inshot type.

.3 Spark ignited pilot with pilot flame safety shut-off.

2.6 CONTROLS

.1 Combustion safety controls.

2.7 REMOTE PANEL

.1 Provide remote readout panel for each unit containing:

.1 Signal lights indicating system status, heating system failure and dirty filters.

.2 Check switches proving signal light operation.

.3 System on-off switch.

.4 Fan on-off switch.

.2 Provide gauges in remote panel indicating outside air, mixed air, return air and discharge air temperatures for each deck before heat exchangers.

2.8 CAPACITY

.1 As indicated in schedule.

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 as per manufacturers' instructions.

.2 Manufacturer to certify installation, supervise start-up and commission unit.

3.3 FIELD QUALITY CONTROL

.1 General:

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Verify accessibility, serviceability of components including motorized dampers, filters, fans, motors, operators, sensors, electrical disconnects.

.3 Performance Verification:

.1 General:

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems, supplemented as specified herein.

.2 Air Handling Units:

.1 Check for smooth, vibration less correct rotation of supply fan impeller.

.2 Measure supply fan capacity.

.3 Adjust impeller speed as necessary and repeat measurement of fan capacity.

.4 Measure pressure drop each component of air handling unit.

.5 Set outside air dampers for the % of outside air required by design and repeat measurements of fan capacity.

.6 OAD: verify for proper stroking.

.7 Measure DBT, of SA.

.8 Measure flow rates (minimum and maximum) of SA.

.9 Simulate maximum heating load and:

.1 Verify temperature rise across heat exchanger.

.2 Perform flue gas analysis. Adjust for peak efficiency.

.3 Verify combustion air flow to heat exchanger.

.4 Simulate minimum heating load and repeat measurements.

.10 Verify operating control strategies, including:

.1 Heat exchanger operating and high limit.

.2 Early morning warm-up cycle.

.3 Alarms.

.4 Voltage drop across thermostat wiring.

.5 Operation of remote panel including pilot lights, failure modes.

.11 Adjust impeller speed as necessary and repeat measurement of return fan capacity.

.12 Check capacity of heating unit.

.13 Refer to other sections of these specifications for PV procedures for other components.

.3 Start-Up:

.1 General: in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.4 Verify accessibility, serviceability of components including motorized dampers, filters, fans, motors, operators, sensors, electrical disconnects.

.5 Verify accessibility, clean ability, drainage of drain pans for coils, humidifiers.

3.4 CLEANING

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.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 SECTIONS

.1 General Requirements:

.2 Concrete:

.3 Mechanical:

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-2006, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.3 No.7, Underground Systems.

.3 CAN/CSA-C22.3 No. 1-01(Update March 2005), Overhead Systems.

.4 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

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 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.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

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

.2 Shop drawings:

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

.2 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.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 If changes are required, notify Contract Administrator of these changes before they are made.

.3 Quality Control:

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material inspection authorities for special acceptance approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

.4 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, 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 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Contract Administrator will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.

.4 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.5 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Contract Administrator.

1.7 SYSTEM STARTUP

.1 Instruct Contract Administrator 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.

.3 Arrange and pay for services of an instrumentation technician to check, adjust, balance and calibrate components and instruct operating personnel.

.4 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 will aspects of its care and operation.

1.8 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

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

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.2 Material and equipment shall be new and free from all defects.

.3 Factory assemble control panels and component assemblies.

2.2 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction, inspection authorities, and Contract Administrator.

.2 Lamacoid, red with white lettering, minimum size 175 x 250 mm

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

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

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.5 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.6 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
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone/LAN	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	

2.7 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.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

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

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 GROUNDING

.1 All circuits shall be installed with dedicated green insulated ground wire.

3.3 Dedicated Neutrals

.1 Each circuit shall have its own dedicated neutral wire. Shared neutral for more than 1 circuit shall not be permitted.

3.4 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.5 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 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, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.6 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets 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.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.7 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. Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and LAN outlets:

.1 General: 300 mm.

.2 Above top of counters or desk: 175 mm.

.5 Wall mounted telephone outlets: 1500 mm.

.6 Fire alarm stations: 1500 mm.

.7 Fire alarm bells: 2100 mm.

3.8 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.9 FIELD QUALITY CONTROL

.1 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.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct the following tests:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Contract Administrator.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

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

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.10 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65-93(R1999), Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 or NEMA to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper bar.

.4 Clamps or connectors for armoured cable, flexible conduit as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors 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 CSA C22.2No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 12 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation for 600 volt system, and 600 V insulations for 208 volt system of chemically cross-linked thermosetting polyethylene material rated RW90

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Hazardous location rated.

.3 Conductors:

- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.4 Insulation:

- .1 Type: ethylene propylene rubber.
- .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V for 600 volt system, and 600 V for 208 volt (or lower) system.

.5 Inner jacket: polyvinyl chloride material.

.6 Armour: interlocking aluminum.

.7 Overall covering: thermoplastic polyvinyl chloride material.

.8 Fastenings:

.1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole aluminum straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1000 mm centers.

.3 Threaded rods: 9 mm dia. to support suspended channels.

.9 Connectors:

.1 Watertight, approved for TECK cable.

.2 Explosion-proof approved for TECK cable, in Wet Well.

2.3 VFD TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductors: three (3) bare copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: continuously corrugated aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole aluminum straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1000 mm centers.

.3 Threaded rods: 9 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable.

.2 Explosion-proof approved for TECK cable, in Wet Well.

2.4 CONTROL CABLES

.1 Type LVT: soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW with shielding of braid and metallized tapes over each pair and over all conductors and overall covering of PVC jackets and interlocked armour of aluminum strip.

.3 600 V type: stranded annealed copper conductors, sizes as indicated cross-linked polyethylene type RW90 (x-link) with shielding of braid over each pair of conductors and overall covering of thermoplastic jacket and interlocked armour.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 260534.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Lay cable in cabletroughs in accordance with Section 260534.

.3 Use approved connectors

.4 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF VFD TECK CABLE 0 -1000 V

.1 Install cables from output of VFD drives to motor

.1 Group cables wherever possible on channels.

.2 Use approved connectors

.3 Terminate cables in accordance with manufactures recommendations and Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.4 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

3.5 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

.3 CAN/CSA Z32-1999, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

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 indicated.

.3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.4 Plate electrodes: galvanized surface area 0.2 m^2, 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.6 Insulated grounding conductors: green, type RW90.

.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 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where conduit is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 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.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.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.

3.2 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, plate electrodes and make grounding connections.

.5 Bond separate, multiple electrodes together.

.6 Use size 2/0 3/0 4/0 AWG copper conductors for connections to 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.

3.3 Field Quality Control

.1 Perform tests.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.4 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutrals of primary 600 V system, secondary 208 V system.

3.5 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.

3.6 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.7 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

.2 Material: Aluminum

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.

.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 with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.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 aluminum straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole aluminum 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 9 mm dia stainless steel threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 9 mm dia stainless steel threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide stainless steel 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 or perforated strap 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 Contract Administrator.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1-2006, Canadian Electrical Code, Part 1.

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 for special devices.

.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.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel 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.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

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-glavanized 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 switches and receptacle.

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 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 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.

.3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum 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 couplings.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

2.2 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 m on centre.

.4 Threaded stainless steel rods, 9 mm diameter, to support suspended channels.

2.3 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 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.4 FISH CORD

.1 Polypropylene.

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 and in unfinished areas.

.3 Surface mount conduits.

.4 Use rigid aluminum threaded conduit except where specified otherwise.

.5 Use epoxy coated conduit underground in corrosive areas.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Use explosion proof flexible connection for connection to explosion proof motors.

.8 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.9 Minimum conduit size for lighting and power circuits: 19 mm.

.10 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.15 Dry conduits out before installing wire.

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 mounted aluminum channels.

.5 Do not pass conduits through structural members except as indicated. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.6 Install RPVC conduits with lettering towards wall.

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 25 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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CAN/CSA-C22.2 No.47-M90(R2001), Air-Cooled Transformers (Dry Type).
- .2 CSA C9-M1981(R2001), Dry-Type Transformers.
- .3 CAN/CSA-C802.2-00

.2 National Electrical Manufacturers Association (NEMA)

- .1 Nema TP-1

1.4 PRODUCT DATA

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

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2No.47 and CSA-C9.

.2 Energy efficiency rating in accordance with CAN/CSA-C802.2-00 and NEMA TP-1.

.3 Design 1.

- .1 Type: ANN.
- .2 kVA and voltage rating as indicated on plans.
- .3 Voltage taps: standard.
- .4 Insulation: Class H, 220 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 1, removable metal front panel, drip hood

.10 Mounting: as indicated on plans

.11 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

.12 Acceptable Manufacturer: Square D, Siemens, Cutler-Hammer or approved equivalent.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Label size: 7.

.1 KVA

.2 Primary voltage

.3 Secondary voltage

.4 1 phase or 3 phase

.5 Circuit number

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on floor. Provide 100 mm concrete housekeeping pad.

.3 Ensure adequate clearance around transformer for ventilation.

.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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

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

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2No.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.

.2 600 V panelboards: bus and breakers rated for 14 kA (symmetrical) interrupting capacity or as indicated.

.3 120/208 V panelboards: bus and breakers rated for 10 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 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - 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 City.

.5 Lock-on devices for fire alarm, control panel, emergency, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results – Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 29 10 – Motor Starters to 600 V.

1.2 SUBMITTALS

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

.2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

.4 Submit shop drawings and indicate:

- .1 Outline dimensions.
- .2 Configuration of identified compartments.
- .3 Floor anchoring method and dimensioned foundation template.
- .4 Cable entry and exit locations.
- .5 Dimensioned position and size of busbars and details of provision for future extension.
- .6 Schematic and wiring diagrams.

.5 Closeout Submittals: provide operation and maintenance data for motor control centre for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

- .1 Include data for each type and style of starter.

1.3 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

.1 600 V, 60Hz, delta connected, 3 phase, 3 wire, grounded neutral.

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor CSA 1 gasketted enclosure, front mounting.

.4 Class I, Type B-t complete with pull-apart terminals.

2.3 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, minimum 305 mm high, as indicated.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Incoming cables to enter at top with terminals.

.8 Provision for outgoing cables to exit via top with terminals.

.9 Removable lifting means.

.10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.11 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

2.4 SILLS

.1 Continuous 25 mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

.1 Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: as indicated, minimum 600 A.

.2 Branch vertical busbars: 300 A.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current of 42 kA rms symmetrical.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

.2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab

2.7 MOTOR STARTERS AND DEVICES

.1 See Section 26 29 10 – Motor Starters to 600 V.

2.8 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.

.5 Racking lever for unit removal and installation.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front.

.7 Devices and components by one manufacturer to facilitate maintenance.

.8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

2.9 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 00 - Common Work Results - For Electrical.

2.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - For Electrical.

.1 Motor control centre main nameplate: size No. 7, engraved as indicated.

.2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.11 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results - For Electrical.

.2 Paint motor control centre exterior light gray and interiors white.

2.12 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

.3 Manufacturer to provide proof of quality control program in accordance with CAN/CSA-Q9000.

Part 3 Execution

3.1 INSTALLATION

.1 Supply and install concrete housekeeping pad for motor control centre.

.2 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.3 Make field power and control connections as indicated.

.4 Ensure correct overload heater elements are installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - For Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hours period.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SWITCHES

.1 15 or 20 A, 120 V, 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 brown toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Brown urea moulded 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.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Brown urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 RATED SWITCHES

.1 20 A, 120 V, single pole, switches rated for Class I Div I, Groups C & D.

.2 Manually-operated tumbler ac switches.

.3 Hubbell FXS Series or approved equal in accordance with B6.

2.4 RATED RECEPTACLES

.1 20 A, 120 V, rated for Class I Div I, Groups C & D.

.2 NEMA configuration 5-20R.

.3 Supply five (5) NEMA 5-20P plugs c/w mesh grip.

.4 Hubbell UGP/UGR Acceptor Series or approved equal in accordance with B6.

2.5 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 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 05 00 - Common Work Results - Electrical as indicated.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical as indicated.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Rated Switches:

.1 Install rated switches in all hazardous locations.

.2 Use rated connectors and install according to manufactures recommendations.

.5 Rated Receptacles:

.1 Install rated receptacles in all hazardous locations.

.2 Use rated connectors and install according to manufactures recommendations.

.3 Turn over spare plugs to City.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

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

.2 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.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers: 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 3-10 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 10 kA symmetrical rms interrupting capacity rating. Rating to match panel.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.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.

2.3 MAGNETIC BREAKERS DESIGN B

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS DESIGN D

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

2.5 MANUFACTURERS

.1 Acceptable manufacturer: Square D, Cutler Hammer, Siemens.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Heavy duty non-fusible, horsepower rated disconnect switch in CSA Enclosure 12, 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 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

.6 Acceptable Manufacturer: Square D, Cutler Hammer, Siemens.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches as indicated and as required by CSA C22.1.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC)

.1 IEC 947-4-1-1990, Part 4: Contactors and motor-starters.

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

Part 2 Products

2.1 MATERIALS

.1 EEMAC rated motor starters.

2.2 MANUAL MOTOR STARTERS

.1 Single phase manual motor starters of size, type, rating, and enclosure type EEMAC 12, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One overload heater, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch: oil tight labelled as indicated.

.2 Indicating light: oil tight type and colour as indicated. LED lamp

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 EEMAC rate magnetic and combination magnetic starters of size (half size not acceptable), type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type, 120VAC coil.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.5 Enclosures shall be EEMAC 12.

.2 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control motor circuit interrupter, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Pushbuttons and selector switches: oil tight, labelled as indicated.

.2 Indicating lights: oil tight type and color as indicated, LED lamp.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, black plate, white letters, size 3 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Mechanical: Division 23

1.2 SCOPE

.1 Division 23 Contractor shall supply Variable Frequency Drive (VFD) controllers for heating, ventilation, and air conditioning (HVAC) equipment as herein specified.

.2 Division 26 Contractor shall install, wire and connect HVAC VFD controllers and indicated on the drawings.

1.3 STANDARD MOTOR

.1 All VFDs supplied under this Contract meet or exceed the following specifications.

.2 Provide a complete inventory (as specified) of spare cooling fans, and fuses, for each VFD supplied.

.3 The adjustable frequency controller shall be designed to operate standard squirrel cage induction motor with a 1.15 S.F. or definite purpose motors meeting National Electric Manufacturers Association (NEMA) MG1 Part 31.

.4 Harmonic loading will not exceed a motor service factor of 1.0.

.5 Products shall comply with Institute of Electrical and Electrical Engineers (IEEE) Standard 519.

.6 VFD unit shall be Underwriters Laboratories (UL) listed and Canadian Standards Association (CSA) certified.

.7 VFD unit shall comply with applicable requirements of the latest standards of CSA, American National Standards Institute (ANSI), IEEE and the Canadian Electrical Code.

1.4 TESTS

.1 Factory testing

.1 VFD units are to be factory tested prior to shipment. Provide confirmation from factory of actual tests completed and results.

.2 Provide certified copies of production test results required by CSA and Electrical and Electronic Manufacturer's Association of Canada (EEMAC), prior to acceptance of the equipment.

.2 Field testing

.1 The VFD supplier shall provide on site startup, fine-tuning, commissioning, operator training and instruction.

.2 The VFD supplier shall provide site functionality test reports indicating loading/current levels during testing as well as control point proving results.

.3 The VFD supplier shall ensure shaft to ground voltages do not exceed 1.5 volts at any speed or load requirement.

.4 Allow for all costs and labour for as many trips as necessary to complete requirements.

.5 It is the intent of this specification to provide a VFD installation that does not adversely affect the electrical system. Included in the Contract Documents is information on the electrical system including:

.1 Single line drawing.

.2 Additional information on electrical system layout and load profile.

.3 The VFD supplier can use this information to evaluate the predicted effect of the VFD installation on the electrical system and advise the Contract Administrator of these effects. For the purposes of analysis, the point of common coupling (PCC) will be taken as the secondary of the main distribution transformers.

.6 The Contractor, in conjunction with the Contract Administrator, will conduct a harmonic analysis upon completion of fine-tuning and commissioning phase of the installation. The harmonic analysis will be conducted at 50%, 75%, and 100% speed under normal load conditions and perform a Fourier (FFT) transform analysis spectrum for each waveform covering the fundamental to the 31st harmonic. Should the waveform analysis indicate that either the input or output voltage and current levels of the VFD(s) exceed NEMA Standards for electric motors and IEEE 519, the VFD supplier shall provide, at their cost, all the necessary line filtering equipment to correct the harmonic distortion back to the levels prior to the installation of the VFD(s).

.3 Provide certified copies of all production test results required by CSA and NEMA.

1.5 WARRANTY

.1 The VFD supplier shall provide a warranty coverage for a period of two (2) years upon the Contractor being granted Total Performance and the warranty period has commenced.

.2 VFD supplier will review specifications of motors for application compatibility. The Contractor shall obtain and submit written approval from both the motor and VFD suppliers confirming that both pieces of equipment are compatible when used together to maintain the required warranty.

.3 The Contractor shall indicate the level of local support detailing response time if a piece of equipment should happen to fail or malfunction. Details are to include estimated replacement part delivery times, as well as nearest parts depot location and a contact name and phone number. This must be included with all bid submissions.

.4 The VFD supplier shall guarantee that parts for drive units will be available for a minimum of ten (10) years from time of delivery.

1.6 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.7 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include operation and maintenance data for each type and style of VFD.

.3 Provide parameter settings for each VFD.

1.8 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

Part 2 Products

2.1 VARIABLE FREQUENCY DRIVES

.1 Variable Frequency Drives as supplied by one of the following acceptable manufacturers:

.1 Asea Brown Boveri Ltd. (ABB) - ACS 800 series.

.2 Variable speed controller shall be electronic adjustable frequency and voltage output unit.

.3 The VFD shall employ a minimum 6-pulse pulse width modulated (PWM) inverter system utilizing Insulated Gate Bipolar Transistors (IGBT) power switching devices and come complete with line reactors or DC link filters.

.4 The drive shall be rated for continuous duty while operating a NEMA design induction motor of the sizes and operating voltages as shown in the following schedules and indicated on the drawings. Drive output shall be sized for a 1.0 motor service factor. The VFD shall have a current rating at least 10% in excess of the motor full load amp rating.

Overload service factors of 110% for thirty minutes and 135% for one minute must be provided to ensure adequate safety margins. VFD selection shall be based on load current at constant torque ratings. Do not size VFD's based on variable torque maximums.

.5 Input voltage shall be as indicated on motor schedules and drawings (line voltage variation ±10%) Based on 347/600 volt systems (Not 575V). Line frequency variation ±5%. Output voltage shall vary with motor speed to nominal motor voltage. Speed stability shall be ±1%. Drive shall match torque characteristic of load.

.6 Input frequency setting signal will be selective between 4-20 mA or 0-10v DC. Output speed monitoring signal shall be selective between 4-20 mA or 0-10 v DC.

.7 Enclosure:

.1 Drive shall be installed in individual CSA 1 enclosure, drip proof or Nema 12 as indicated on drawings. Filters to be provided for any forced air-cooled enclosures as required by the supplier. VFD(s) shall be suitable for mounting in a typical building electrical room and shall be able to operate under these conditions with no special cleaning requirements. VFD cabinets shall be mounted in such a way that there is adequate room for ventilation and no build up of heat. The minimum clearance in front of VFDs is 1m.

.8 Protective devices to be incorporated are:

.1 Fast acting electronic circuit board protective devices for protection of electronic components.

.2 Line reactor, DC link or filter in the drive input to protect electronic components from transient voltage conditions.

.3 Integral electronic motor overload protection adjustable up to 150% of motor rating for sixty (60) seconds.

.4 Overcurrent instantaneous trip 250%.

.5 Programmable short-circuit protection.

.6 Programmable ground fault protection.

.7 Overvoltage/overcurrent DC bus monitor/protection.

.8 Undervoltage protection.

.9 Loss of phase and phase unbalance protection.

.10 Inverter over-temperature protection.

.11 Capable of running without motor for startup.

.12 Output filter package (as required) to limit motor voltage to 1200 volts maximum at motor terminals. A reflective wave trap mounted at the motor may be used to accomplish this.

.13 Longlead (motor feeder) filter package, as required for these installations. Supplier is responsible to determine where this will be required, and must indicate as to the requirement or non-requirement of longlead filter package components in their bid submission, and the Contractor is responsible for carrying all such costs in their bid price.

.14 Maximum acceptable noise level is 80 dBA at 1 m.

.9 Operation features:

.1 Integral flush mounted display in VFD cover with keypad for programming, monitoring and operating of drive, accessible through password or other acceptable security measure only. Remote keypads, completely duplicating functions of integral keypads, shall also be provided for all VFD(s) located inside a fan plenum. The remote keypads in these cases shall be located adjacent to the door entering the plenum.

.2 Fault shutdown and indication.

.3 Automatic restart following power outage.

.4 Ability to disconnect motor load for setup or trouble.

.5 Manual speed control (potentiometer or keypad).

.6 Adjustable maximum and minimum speed.

.7 Acceleration and deceleration time adjustment.

.8 Controller “stop” interlock from a NC dry contact.

.9 Drive fault contact.

.10 Stop/start push buttons on keypad.

.11 Transient voltage protection.

.12 Provide three (3) dry “C” type contacts programmable for any combination of the following:

.1 Running (output frequency being generated).

.2 Fault lockout.

.3 Stopped.

.4 At speed.

.5 Under speed.

.6 Forward/Reverse.

.7 Low reference.

.8 Manual/Auto Mode.

.9 Local/Remote Mode.

.13 Soft start sequence.

.14 Minimum of three (3) skip frequencies.

.15 Provide Hand/Off/Auto selector switch. Keypad HOA is not an acceptable replacement.

.16 Password protection of parameter programming or some method to prevent unauthorized changes.

.17 Output speed monitoring signal to be selective between 4-20 mA. or 0-10 volt.

.18 Data communication link.

.1 Data communication links shall be provided with various components in the electrical distribution system as defined in various Section of this Division and as shown on drawings. The data communication link shall be Modbus Ethernet.

.2 Motor control data communication link.

.3 Each variable frequency drive shall be provided with Ethernet data communication link capable of communicating with the DSC System.

.10 Environmental Capabilities: The drive shall operate without mechanical or electrical damage under any combination of conditions as follows:

.1 Ambient temperature -0° to 40°C.
.2 Humidity 0 to 90% (non condensing).
.3 Vibration up to 0.5 g.
.4 Altitude 0 to 1250 m.

.11 Diagnostic and indicating features:

.1 Power On indication.
.2 Percentage speed indicator.
.3 Overload indication.
.4 Short circuit indication.
.5 Ground fault indication.
.6 Overvoltage indication.
.7 Undervoltage indication.
.8 High temperature (controller).
.9 AC voltmeter (output).
.10 AC ammeter (output).
.11 Inverter ready.
.12 Inverter fault.
.13 External fault.

.12 Cooling System:

.1 VFD supplier to provide adequate proven cooling devices for VFD equipment.
.2 VFD supplier to ensure any enclosure utilized will not allow a build up of heat. This can be accomplished by use of fans and / or sufficient guarded, filtered openings.

.13 Control wiring shall be TEW 105° C rise.

.14 Terminal blocks in separate control enclosures for remote interface shall be Weidmueller SAK6N or approved equivalent.

.15 Provide wire markers at both ends of all control wires, Electrovert Type Z or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Identify mounting requirements and include all materials and labour, including concrete pads for all floor-mounted equipment.

.2 Install VFD(s) in locations as indicated on drawings, and connect up all necessary wiring. All VFD(s) are to be mounted as close to the motor as possible. Follow manufacturer’s recommendations for maximum distance between the VFD and the motor. The minimum clearance in front of VFDs is 1 m. Where required, install longlead motor package.

.3 This Division shall extend analog input signal cable, analog speed indicating output cable, shutdown contact and drive fault contact from the drive to the DCS System. Analog cable shall be No. 16 shielded twisted pair cable. Control wiring shall be run in conduit separate from VFD supply and motor feeder conduits.

.4 Contractor shall connect all interlocks including (but not limited to) vibration switch, freeze stats, and fire alarms to the VFD. These interlocks will be active in both the Hand (local) and Auto (remote) configurations.

.5 Contractor shall ensure that all control and stop commands shut down the drive as per manufacture’s recommended procedure (example, ramp to stop, ramp and hold, or coast to stop). Contactors on the line or load side of the drive are not an approved method of control.

.6 MCC disconnect switch, VFD and motor isolation switch are to be labelled with proper shutdown procedures as follows:

“Caution”
“Ensure VFD is stopped before operating this switch”
“Record all faults before resetting”

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Contractor shall be responsible to bring Factory representative back to reset, repair, and re-commission the VFD during the two (2) year warranty period if problems arise with the normal operation of the VFD. This includes prevention of any motor shaft voltages exceeding 1.5 volts when referenced to ground.

INSTALLED VFD TEST

VFD EQUIPMENT NO. _____ DATE OF TEST_____

DRIVEN MOTOR EQUIPMENT NO. _____

DRIVEN LOAD CHARACTERISTIC: CONSTANT TORQUE _____
VARIABLE TORQUE _____

SETPOINTS:
MINIMUM FREQUENCY _____Hz MAXIMUM FREQUENCY _____Hz

ACCELERATION TIME _____Sec DECELERATION TIME _____Sec

SPEED RANGE: MANUAL _____to _____RPM
CDACS _____to _____RPM

VFD CURRENT AT FULL LOAD: PH.A. _____Amp
PH.B _____Amp
PH.C _____Amp

MOTOR CURRENT: PH.A. _____Amp
PH.B _____Amp
PH.C _____Amp

MOTOR NAMEPLATE DATA:
MFR.: _____MFR. TYPE _____FRAME _____ hp_____
VOLTS: _____PHASE _____RPM _____SERVICE FACTOR_____
FLA:_____FREQ._____(Hz) AMBIENT TEMP. RATING _____°C
TIME RATING _____ DESIGN LETTER_____
kVA CODE LETTER _____ INSULATION CLASS _____

CERTIFIED _____ DATE _____
Contractor's Representative

WITNESSED _____ DATE _____

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Natural gas engine driven generator sets above 30kW rating, normally 3 phase.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/National Electrical Manufacturers' Association (NEMA)

.1 ANSI/NEMA MG1-1998, Motors and Generators.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CSA-C282-00, Emergency Electrical Power Supply for Buildings.

.2 CSA B149.1-00 Natural Gas and Propane Installation Code.

.3 International Organization for Standardization (ISO)

.1 ISO 3046-1-2002, Reciprocating Internal Combustion Engines - Performance - Part 1: Declarations Of Power, Fuel And Lubricating Oil Consumptions, And Test Methods.

1.4 SYSTEM DESCRIPTION

.1 Generating system consists of:

.1 Natural gas engine.

.2 Alternator.

.3 Alternator control panel.

.4 Automatic transfer equipment, including closed transition re-transfer and manual by-pass switch.

.5 Battery charger and battery.

.6 Automatic engine room ventilation system.

.7 Fuel supply system.

.8 Exhaust system.

.9 Steel mounting base with vibration isolation springs.

.2 System designed to operate as emergency standby power source and shall be meet CSA-C282.

1.5 SHOP DRAWINGS

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

.2 Include:

- .1 Engine: make and model, with performance curves.
- .2 Alternator: make and model.
- .3 Voltage regulator: make, model and type.
- .4 Automatic transfer switch: make, model and type.
- .5 Manual bypass switch: make and model.
- .6 Battery: make, type and capacity.
- .7 Battery charger: make, type and model.
- .8 Alternator control panel: make and type of meters and controls.
- .9 Governor type and model.
- .10 Automatic engine room ventilation system.
- .11 Cooling air requirements in m^3/s.
- .12 British standard or DIN rating of engine.
- .13 Flow diagrams for:
  - .1 Fuel.
  - .2 Cooling air.
- .14 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, and total weight.
- .15 Continuous full load output of set at 0.8PF lagging.
- .16 Description of set operation including:
  - .1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
  - .2 Manual starting.
  - .3 Automatic shut down and alarm on:
    - .1 Overcranking.
    - .2 Overspeed.
    - .3 High engine temp.
    - .4 Low lube oil pressure.
    - .5 Short circuit.
    - .6 Alternator overvoltage.
    - .7 Lube oil high temperature.
    - .8 Over temperature on alternator.
  - .4 Manual remote emergency stop.
- .17 Break-in period for engine, operating hours at 80% load.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.7 WARRANTY

.1 For Work of this Section12 month warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 60 months or 1500 operating hours, whichever occurs first.

1.8 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 2 fuel filter replacement elements.

.2 2 lube oil filter replacement elements.

.3 2 air cleaner filter elements.

.4 2 sets of fuses for control panel.

.5 Special tools for unit servicing.

1.9 SOURCE QUALITY CONTROL

.1 Factory test generator set including engine, alternator, control panels, and accessories in presence of Contract Administrator. Include travel, lodging, etc for the City and his representative to witness the generator testing at the manufacturer’s facility.

.2 Notify Contract Administrator 5 days in advance of date of factory test.

.3 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:

.1 Date.

.2 Generator set serial no.

.3 Engine, make, model, serial no.

.4 Alternator, make, model, serial no.

.5 Voltage regulator, make and model.

.6 Rating of generator set, kW, kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.3 Contract Administrator's signature on completed forms to indicate concurrence in results of test.

.4 Tests:

.1 With 100% rated load, operate set for 6 h, taking readings at 30 min intervals, and record following:

.1 Time of reading.

.2 Running time.

.3 Ambient temp in C.

.4 Lube oil pressure in kPa.

.5 Lube oil temp in C.

.6 Engine coolant temp in C.

.7 Exhaust stack temp in C.

.8 Alternator voltage: phase 1, 2, 3.

.9 Alternator current: phase 1, 2, 3.

.10 Power in kW.

.11 Frequency in Hz.

.12 Power Factor.

.13 Battery charger current in A.

.14 Battery voltage.

.15 Alternator cooling air outlet temp.

.2 After completion of 6 h run, demonstrate following shut down devices and alarms:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.6 Alternator overvoltage.

.7 Low battery voltage, or no battery charge.

.8 Manual remote emergency stop.

.9 High alternator temperature.

.3 Next install continuous strip chart recorders to record frequency and voltage variations during load switching procedures. Each load change delayed until steady state conditions exist. Switching increments to include:

.1 No load to full load to no load.

.2 No load to 70% load to no load.

.3 No load to 20% load to no load.

.4 20% load to 40% load to no load.

.5 40% load to 60% load to no load.

.6 60% load to 80% load to no load.

.5 Demonstrate:

.1 Automatic starting of set and automatic transfer of load on failure of normal power.

.2 Automatic shut down of engine on resumption of normal power.

.3 That battery charger reverts to high rate charge after cranking.

.4 Automatic changeover from primary fuel (natural gas) to secondary fuel (propane gas).

.6 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

.7 All tests to be repeated on site in their entirety.

Part 2 Products

2.1 NATURAL GAS ENGINE

.1 Natural gas engine: to ISO 3046-1.

.1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.

.2 Naturally aspirated or turbo charged and after cooled, synchronous speed 1800 r/min.

.3 Capacity:

.1 Rated continuous power in kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.

.1 Under following site conditions:

.1 Altitude: 1000 m.

.2 Ambient temperature: 40 degrees C.

.3 Relative humidity: 95 %.

.2 Engine overload capability 110% of continuous output for 1 hour within 12 hours period of continuous operation.

.4 Cooling System:

.1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side, with anti-freeze non-sludging above minus 46 degrees C.

.2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 degrees C.

.3 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in room ambient 0 degrees C.

.1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.

.5 Fuel:

.1 Natural gas

.6 Fuel system:

.1 Natural Gas train to CSA B149.1-00 Natural Gas and Propane Installation Code.

.7 Inlet system: Air cleaner housing with cartridge type air filter(s).

.8 Governor:

.1 Electronic type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of plus or minus 0.25%.

.9 Lubrication system:

.1 Pressure lubricated by engine driven pump.
.2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.
.3 Lube oil cooler.
.4 Engine sump drain valve.
.5 Oil level dip-stick.

.10 Starting system:

.1 Positive shift, gear engaging starter 24V dc.
.2 Cranking limiter to provide 3 cranking periods of 10s duration, each separated by 5 s rest.
.3 Lead acid, 24V storage battery with sufficient capacity to crank engine for 1min at 0 degrees C without using more than 25% of ampere hour capacity.
.4 Battery charger : constant voltage, solid state, two stage from trickle charge at standby to boost charge after use. Regulation: plus or minus 1% output for plus or minus 10% input variation. Automatic boost for 6h every 30 days. Equipped with dc voltmeter, dc ammeter and on-off switch. Minimum charger capacity: 10 A.
.5 Batteries to be housed in rack or cabinet complete with cover to guard against accidental contact.

.11 Vibration isolated engine instrument panel with:

.1 Lube oil pressure gauge.
.2 Lube oil temperature gauge.
.3 Lube oil level gauge.
.4 Coolant temperature gauge.
.5 Coolant level gauge.
.6 Running time meter: non-tamper type.

.12 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

.13 Drip tray.

2.2 ALTERNATOR

.1 Alternator: to ANSI/NEMA MG1.

.2 Rating: 3phase, 600 V, 3 wire, 150 kW, 60Hz, at 0.8PF.

.3 Output at 40 degrees C ambient:

.1 100% full load continuously.
.2 110% full load for 1h.
.3 150% full load for 1 min.

.4 Revolving field, brushless, single bearing.

.5 Drip proof.

.6 Amortisseur windings.

.7 Synchronous type.

.8 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.9 Exciter:permanent magnet.

.10 EEMAC H insulation on windings.

.11 Thermistors or platinum resistance temperature transducers embedded in stator winding and connected to alternator control circuitry.

.12 Voltage regulator: thyristor controlled rectifiers with phase controlled sensing circuit:

.1 Stability: 1% maximum voltage variation at any constant load from no load to full load.
.2 Regulation: 2% maximum voltage deviation between no-load steady state and full-load steady state.
.3 Transient: 15% maximum voltage dip on one-step application of 0.8PF full load.
.4 Transient: 10% maximum voltage rise on one-step removal of 0.8PF full load.
.5 Transient: 5 s maximum voltage recovery time with application or removal of 0.8PF full load.

.13 Alternator: capable of sustaining 300% rated current for period not less than 10s permitting selective tripping of down line protective devices when short circuit occurs.

2.3 CONTROL PANEL

.1 Totally enclosed, wall mounted.

.2 Instruments:

.1 Digital 100% solid state circuitry indicating type 2 % accuracy, rectangular face, flush panel mounting:

.1 Voltmeter: ac, scale 0 to 1000 V, 3 Phase (L-L & L-N).
.2 Ammeter: ac, scale 0 to 200 A, (3 Phase & total).
.3 Wattmeter scale 0 to 200 kW, 3 Phase & total.
.4 Frequency meter: scale 55 to 65Hz.
.5 kVA, Total.
.6 kVAR, Total.
.7 kW.h, Total.
.8 kVAR.h, Total.
.9 PF, average total & per phase.
.10 DC voltage.
.11 Coolant temperature.
.12 Oil pressure.
.13 RPM.
.14 Hours run.
.15 System diagnostic

.2 All functions to be selected by keypad.

.3 Instrument Transformers

.1 Potential-dry type for indoor use:

.1 Ratio: 600 to 120.
.2 Rating: 600 V, 60Hz, BIL 10 kV.

.2 Current-dry type for indoor use:

.1 Ratio: as required.
.2 Rating: 600 V, 60Hz, BIL 10 kV.
.3 Positive action automatic short-circuiting device in secondary terminals.

.3 Controls:

.1 Engine start button.
.2 Selector switch: Off-Auto-Manual - Test (at full load or test at no load).
.3 Engine emergency stop button and provision for remote emergency stop button.

.1 Alternator output breaker:

.1 Circuit breaker: bolt-on, moulded case, temperature compensated for 40 degrees C ambient, dual thermal-magnetic trip.

.2 Voltage control rheostat: mounted on inside of control panel.
.3 Operating lights, panel mounted:

.1 "Normal power" pilot light.
.2 "Emergency power" pilot light.
.3 Green pilot lights for breaker on and red pilot lights for breaker off.

.4 Solid state indicator lights for alarm, according to CSA-C282, with 1 set manually reset NO/NC contacts wired to terminal block for remote annunciation on:

.1 Low engine temperature.

.2 Low battery voltage.

.3 Ventilation failure.

.4 Low coolant level.

.5 Automatic transfer switch in bypass mode.

.5 Solid state controller for automatic shutdown and alarms, according to CSA-C282, with 1 set manually reset NO/NC contacts wired to terminal block for remote annunciation on:

.1 Engine overcrank.

.2 Engine overspeed.

.3 Engine high temperature.

.4 Engine low lube oil pressure.

.5 Short circuit.

.6 AC over voltage.

.7 Control switch not in auto.

.6 Lamp test button.

.7 Provision for remote monitoring.

2.4 AUTOMATIC TRANSFER SWITCH

.1 Automatic transfer switch to meet Section 26 36 23 – Automatic Load Transfer Equipment.

2.5 STEEL MOUNTING BASE

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators.

.1 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.3 Sound insulation pads for installation between isolators and concrete base.

2.6 EXHAUST SYSTEM

.1 Refer also to Mechanical drawings.

.2 Heavy duty residential grade horizontally mounted exhaust silencer with condensate drain, plug and flanged couplings. Minimum 20 dBA noise reduction at engine rated output.

.3 Insulated, ULC listed wall thimble complete with rain guard.

.4 Heavy duty flexible engine to exhaust system connector, bellows type with flanged couplings.

.5 Fittings and accessories as required.

.6 Mineral wool insulated exhaust system.

.7 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion, flanged ends.

2.7 FUEL SYSTEM

.1 To CSA B149.1-00 Natural Gas and Propane Installation Code.

.2 Shut-off cock.

.3 Renewable cartridge filter.

.4 Dual valves.

2.8 COOLING AIR SYSTEM

.1 Engine ventilating system:

.1 Recirculating damper assembly with modulating motor.
.2 Cold air inlet damper assembly with modulating motor.
.3 Air discharge and intake gooseneck weatherhoods.
.4 Modulating thermostat.
.5 Replaceable air intake filters.

2.9 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Control panel:

.1 Size 4 nameplates for controls including alternator breakers and program selector switch.
.2 Size 2 nameplates for meters, alarms, indicating lights and minor controls.

2.10 FABRICATION

.1 Shop assemble generating unit including:

.1 Base.
.2 Engine and radiator.
.3 Alternator.
.4 Control panel.
.5 Battery and charger.
.6 Automatic transfer equipment.

2.11 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Alternator control cubicle: paint inside, exterior to match engine and alternator.

.3 Exhaust and inlet air hoods international orange.

.4 Other ducts and racks grey.

.5 Supply 0.25L of grey touch-up enamel.

Part 3 Execution

3.1 INSTALLATION

.1 Locate generating unit and install as indicated.

.2 Install fuel supply system as indicated.

.3 Install ventilating air duct system as indicated.

.4 Pipe muffler drains to nearest floor drain.

.5 Complete wiring and interconnections as indicated.

.6 Start generating set and test to ensure correct performance of components.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Notify Contract Administrator 10 working days in advance of test date.

.3 Supply and connect load bank for on site testing.

.4 Demonstrate:

.1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.

.2 Unit start and shut down on "Manual" control

.3 Unit start and transfer on "Test" control.

.4 Unit start on "Engine start" control.

.5 Operation of manual bypass switch.

.6 Operation of automatic alarms and shut down devices.

.5 Run unit on load for minimum period of 6 hours to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

.6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN3-C13-M83(R1998), Instrument Transformers.

.2 CSA C22.2No.5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.3 CSA C22.2No.178-1978(R2001), Automatic Transfer Switches.

.2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA ICS 2-2000, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

1.4 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment with bypass isolation to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

1.5 SHOP DRAWINGS

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

.2 Include:

.1 Make, model and type.

.2 Load classification:

.1 Tungsten lamp load: kW.

.2 Ballast lamp load: kW.

.3 Motor load: kW.

.4 Restricted use: resistance and general loads, 0.8pf or higher kW.

.3 Single line diagram showing controls and relays.

.4 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.

.2 Test control.

.3 Manual control.

.4 Automatic shutdown.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

Part 2 Products

2.1 MATERIALS

.1 Instrument transformers: to CAN3-C13.

.2 Contactors: to ANSI/NEMA ICS2.

2.2 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

.1 Circuit Breaker Type Transfer Equipment: to CSA C22.2No.5.

.2 Rated: 600 V, 60Hz, 200 A, 3 wire, solid neutral.

.1 Fault withstand rating: 22 kA symmetrical for 3 cycles with maximum peak value of 22 kA.

.2 One normal- three phase molded-case circuit breaker with thermal magnetic, mounted on common base, designed for double throw action, motor operated, mechanically held and interlocked, floor mounted CSA 1 enclosure.

.3 One emergency – three phase moulded-case circuit breaker with thermal magnetic trip, motor operated, and interlocked.

.4 Circuit breakers:

.1 Trip free in closed position.

.2 Interrupting rating: 22 kA symmetrical.

.5 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.

.6 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.

.7 Solid neutral bar, rated: 200 A.

.8 Overlapping neutral contacts on contractor type transfer equipment.

.9 Switchable neutral pole on circuit breaker type equipment.

.10 Bypass breakers for normal and emergency.

2.3 CONTROLS

.1 Selector switch -position "Test", "Auto", "Manual", "Engine start".

.1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.

.2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.

.4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.2 Control transformers: dry type with 120V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

.1 Voltage sensing: 3 phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2V minimum undervoltage and over voltage protection.

.2 Time delay: normal power to standby, adjustable solid state, 0 to 60s.

.3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 0 to 60s delay.

.4 Time delay on retransfer from standby to normal power, adjustable 20s to 10 min.

.5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state, 20s intervals to 10 min.

.6 Time delay during transfer to stop transfer action in neutral position to prevent fast transfer, adjustable, 5s intervals to 180s.

.7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.

.4 Solid state electronic in-phase monitor.

2.4 ACCESSORIES

.1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.

.2 Auxiliary relay to provide 2 N.O. 2 N.C. contacts for remote alarms.

.3 Manual bypass: bypass of both normal and emergency supplies.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Control panel:

.1 For selector switch and manual switch: size 4 nameplates.

.2 For meters, indicating lights, minor controls: size 2 nameplates.

2.6 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Contract Administrator.

.2 Notify Contract Administrator 5 days in advance of date of factory test.

.3 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

.4 In-phase monitor operation.

Part 3 Execution

3.1 INSTALLATION

.1 Locate, install and connect transfer equipment.

.2 Check relays and solid state monitors and adjust as required.

.3 Install and connect battery and remote alarms.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Manual" position and check to ensure proper performance.

.5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.7 Repeat, at 1h intervals, 4 times, complete test with selector switch in each position, for each test.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 21 - Wires and Cables (0-1000 V).

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 12 V dc.

.4 Operating time: 30 min.

.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 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON'.

.10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: mini halogen MR16, 20 W.

.11 Cabinet: suitable for direct to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 NEMA 4X enclosure.

.13 Remote lamp heads in Class I Div I locations shall be rate for the area. Two (2) heads per unit.

.14 Auxiliary equipment:

.1 Magnetic test switch.
.2 Time delay relay.
.3 Service required lamp.
.4 Diagnostic LEDs
.5 Battery disconnect device.
.6 AC input and DC output terminal blocks inside cabinet.
.7 Cord and single twist-lock plug connection for AC.

.15 Acceptable Manufacturer:

.1 Emergi-Lite, Survive-All NXM series battery unit, Survive-All EF39 series remote head, EFXPR series hazardous location remote head.
.2 Lumacell, RG-NX series battery unit, MQM-NX series remote head, RS10XP series hazardous location remote head.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: rigid aluminum, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations.

.3 Remote heads in Class I Div I areas shall be wire with hazardous location rated TECK cable and connectors. Conductors sized in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.

.2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)

.1 NFPA 101-2006, Life Safety Code.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Quality Assurance Submittals:

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

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: NEMA 4X

.3 Clear acrylic faceplate.

.4 Lamps: One or two or multiple LED-12W, 120 V supply over 500,000 hours.

.5 Operation: designed for over 100,000 hours of continuous operation without relamping.

.6 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red letters reading EXIT.

.7 Face plate to remain captive for relamping.

2.2 SELF-POWERED UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: NEMA 4X

.3 Clear acrylic faceplate.

.4 Lamps: One or two or multiple LED-12W, 120 V supply over 500,000 hours.

.5 Operation: designed for over 100,000 hours of continuous operation without relamping.

.6 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red letters reading EXIT.

.7 Downlight: white glass translucent acrylic in bottom of unit.

.8 Face plate to remain captive for relamping.

.9 Supply voltage: 120 V, ac.

.10 Output voltage: 12 V dc.

.11 Operating time: 30 minimum.

.12 Recharge time: 12 hours

.13 Battery: sealed, maintenance free.

.14 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.

.15 Solid state transfer circuit.

.16 Signal lights: solid state, for 'AC Power ON'condition.

.17 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.

.18 Right/left chevron designation as required.

.19 Cabinet: NEMA 4X

.20 Auxiliary equipment:

.1 Test switch.

.2 AC/DC output terminal blocks inside cabinet.

.3 Cord and single twist-lock plug connection for AC power supply.

.21 Acceptable manufacturer: Emergi-Lite, Ready-Lite, Lumacell LER3000 Series

2.3 SELF-LUMINOUS SIGNS

.1 Exit lights:

.1 No power source or wiring required, spark free.

.2 Constructed: metal and plastic.

.3 Source of energy: tritium gas emits constant low energy beta particles to excite phosphor coating on inside of tube.

.4 Viewing distance: in accordance with NFPA.

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 Connect fixtures to exit light circuits.

.3 Ensure that exit light circuit breaker is locked in on position.

END OF SECTION

Part 1 General

1.1 Related Work

.1 Wiring: Section 26 05 21, Wires and Cables 0-1000V.

.2 Conduits: Section 26 05 34, Conduits, Conduit Fastenings and Conduit Fittings.

1.2 References

.1 CAN/ULC-S524-2001, Installation of Fire Alarm Systems.

.2 ULC-S525-1999, Audible Signal Appliances for Fire Alarm.

.3 CAN/ULC-S527-1999, Control Units, Fire Alarm.

.4 CAN/ULC-S528-1991, Manual Pull Stations.

.5 CAN/ULC-S529-2002, Smoke Detectors, Fire Alarm.

.6 CAN/ULC-S530-M1991, Heat Actuated Fire Detectors, Fire Alarm.

.7 CAN/ULC-S536-M97, Inspection and Testing of Fire Alarm Systems.

.8 CAN/ULC-S537-2004, Verification of Fire Alarm Systems.

.9 National Fire Alarm Code, NFPA 72-2002.

1.3 System Description

.1 Fully supervised, microprocessor-based, single stage, fire alarm system, utilizing digital techniques for data control, and multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to fire department.

.3 Sequence of Operation:

.1 Activation of any heat detector, smoke detector (standard alarm level) or manual pull station shall constitute general alarm condition and both components of horn/strobes shall operate.

.4 Zoned, non-coded single stage.

.5 Modular in design to allow for future expansion.

.6 Operation of system shall not require personnel with special computer skills.

.7 System to include:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.

.2 Power supplies.

.3 Initiating/input circuits.

.4 Output circuits.

.5 Auxiliary circuits.

.6 Wiring.

.7 Manual and automatic initiating devices.

.8 Audible/strobe signalling devices.

.9 End-of-line resistors.

.10 Capable of disconnecting auxiliary relays (fan shutdown, door holder, etc.) for fire alarm testing and drills. This function to activate "Trouble Signal".

.11 Local and remote annunciator displays.

.12 Printer Event log memory chip.

.13 Historic time/date event recorder.

1.4 Requirements of Regulatory Agencies

.1 System:

.1 Subject to Manitoba Fire Commissioner (FC) approval.

.2 Subject to FC inspection for final acceptance.

.2 System components: listed by ULC and comply with applicable provisions of National Building Code and Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

1.5 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Include:

.1 Detail assembly and internal wiring diagrams for control units.

.2 Overall system riser wiring diagrams identifying control equipment, initiating zones and signaling circuits; identifying terminations, terminal numbers, conductors and raceways.

.3 Details for devices.

.4 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.5 Step-by-step operating sequence, cross central control unit referenced to logic flow diagram.

.6 Wording for device identification for Central Control Unit Annunciator Display.

.7 Contract Administrator will provide electronic copy of floor plans at no charge.

1.6 Operation and Maintenance Data

.1 Provide operation and maintenance data for fire alarm system for incorporation into manual. Contractor to submit four (4) copies of O&M manuals to City upon completion of the project.

.2 Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.4 Fire alarm manufacturer’s drawings with device designations.

.5 List of recommended spare parts for system.

.6 Certificate of Verification from fire alarm system manufacturer's agent and Authority Having Jurisdiction.

1.7 Maintenance

.1 Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Contract Administrator.

.2 Provide individual price with bid for temporary program changes during construction period, to include zone labels, control functions, system operation.

1.8 Spare Parts

.1 Provide 3 spare control fuses for each size supplied.

.2 Provide 1 detector for each type supplied (smoke, heat).

.3 Provide 1 pull station.

.4 Provide 1 horn/strobe of each type.

.5 Provide 1 End of Line Resistor.

Part 2 PART 2 - PRODUCT

2.1 Materials

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S524.

.4 Control unit: to CAN/ULC-S527.

.5 Manual pull stations: to CAN/ULC-S528.

.6 Thermal detectors: to CAN/ULC-S530.

.7 Smoke detectors: to CAN/ULC-S529.

.8 Visual alarms to CAN/ULC-S526.

2.2 System Operation: Single Stage - Signals Only

.1 Actuation of any alarm initiating device to:

- .1 Cause electronic latch to lock-in alarm state at central control unit.
- .2 Indicate zone and initiating device of alarm at central control unit, remote annunciator and graphic display.
- .3 Cause audible signalling devices to sound continuously throughout building and at central control unit.
- .4 Transmit trouble and alarm signal to fire department via central station.
- .5 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement.

.2 Acknowledging alarm: indicated at central control unit.

.3 Possible to silence signals by "alarm silence" switch at control unit, after 60 s period of operation.

.4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.5 Actuation of supervisory devices to:

- .1 Cause electronic latch to lock-in supervisory state at central control unit.
- .2 Indicate respective supervisory zone and initiating device at central control unit and at remote annunciators.
- .3 Cause audible signal at central control unit to sound.
- .4 Activate common supervisory sequence.

.6 Resetting alarm and supervisory device not to return system indications/functions back to normal until control unit has been reset.

.7 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.

.3 Initiate “Trouble” signal to Monitoring Station.

.8 Trouble on system: suppressed during course of alarm.

.9 Trouble condition on any circuit in system not to initiate alarm conditions.

.10 Class B wiring.

2.3 Control Panel

.1 Central control unit (CCU).

.1 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.

.2 Minimum capacity of 94 intelligent detectors and 99 monitor/control modules.

.3 System to provide for priority reporting levels, with fire alarm points and pre-alarm assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.

.4 Integral power supply, battery charger and standby batteries.

.5 Basic life safety software: retained in non volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (e.g. zone labels, priorities) and changing of system operation software.

.6 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.7 Support up to 4 RS-232-C I/O ports. CCU output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC.

.8 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.

.9 Software and hardware to maintain time of day, day of week, day of month, month and year.

.10 Software to operate variable sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

.11 Replacement of initiating/signalling devices shall not require additional programming or external programming devices.

.12 Fire Alarm Control Panel and all components to be Year 2000 compliant.

.13 Approved Product: Notifier NFS-320 or Simplex equal.

2.4 Power Supplies

.1 120 V, 60 Hz as primary source of power for system.

.2 Voltage regulated, current limited distributed system power.

.3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.

.4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss. Battery power supply to provide 30 minutes of alarms after 24 hour power failure.

.5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.6 Standby batteries: sealed, maintenance free, 10 year long life.

.7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.5 Initiating/ Input Circuit

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors, sprinkler flow and tamper switches wired in DCLB configuration to central control unit.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".

.4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLB configuration to central control unit.

.5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

.6 The loading of device loops shall be based on approximately 80% load. Provide additional loops to comply with this loading.

2.6 Alarm Output Circuits

.1 Alarm output circuit: connected to signals, wired in class B configuration to central control unit.

.1 Signal circuits' operation to follow system programming; capable of sounding horns and activating strobes separately and continuously. Each signal circuit: rated at 2.5 A, 24 VDC; fuse-protected from overloading/overcurrent.

.2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

.3 The loading of bell and strobe circuits shall not exceed 75% circuit capacity. Provide additional circuits to comply with this loading.

2.7 Auxiliary Circuits

.1 Auxiliary contacts for control functions.

.2 Actual status indication (positive feedback) from controlled device.

.3 Alarm and supervisory trouble on system to cause operation of programmed auxiliary output circuits. Relays shall be monitored for open coil or shorted conditions.

.4 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.5 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system. Timing circuit: controlled by CCU.

.6 Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected, independent Form C contacts, 4 relays/module.

2.8 Wiring

.1 Shielded, twisted copper conductors: rated 300 V minimum.

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 12 AWG minimum, and in accordance with manufacturer's requirements.

.4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

2.9 Manual Alarm Stations

.1 Addressable manual pull station.

.1 Pull lever, surface or semi-flush wall mounted type, single action, single stage, electronics to communicate station's status to addressable module over 2 wires and to supply power to station. Station address to be set on station in field.

.2 Approved Product: Notifier NBG-12LX or Simplex equal.

2.10 Automatic Alarm Initiating Devices

.1 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 88°C.

.1 Electronics to communicate detector's status to addressable module/transponder.

.2 Device to be provided with isolator base for every 25 devices.

.3 Detector address to be set on detector base in field.

.4 Approved Product: Notifier FST-851A Series or Simplex equal.

.2 Non-addressable heat detectors

.1 Fire detection devices to Model CR135 EWT.

2.11 Audible/Strobe Signal Devices

.1 Red enclosure.

.2 Weatherproof enclosure.

2.12 End-of-line Devices

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open , short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.13 Addressable Field Modules

.1 Addressable modules shall monitor and supervise dry contact input devices. Installation shall include box and face plates.

.2 Approved Product: Notifier FMM-1 or Simplex equal.

2.14 Isolator Base

.1 Isolator Base:

.1 The isolator base shall support all detector types and have the following minimum requirements:

.1 The operation of the isolator base shall be controlled by its respective detector processor. Isolators which are not controlled by a detector processor shall not be accepted.

.2 The isolator shall operate within a minimum of 23 msec. of a short circuit condition on the communication line.

.3 Following a short circuit condition, each isolator/detector shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator/detectors not capable of performing independent self-tests shall not be acceptable.

.2 When connected in Class A configuration, the Loop Controller shall identify an isolated circuit condition and provide communications to all non-isolated analog devices. Loop wiring shall be Class "AL, T-tapping is allowed between isolator bases/modules only. Isolator bases to be provided when a loop is used between floors, between areas which have fire separations. Do not exceed 12 devices on a branch without an isolator.

.3 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

.4 The Loop Controller shall support up to 96 isolator bases.

2.15 Modules

.1 Single Input Module

.1 The intelligent Single Input Module shall be capable of a minimum of 4 personalities, each with a distinct operation.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The single input module shall support the following circuit types:

.1 Alarm Latching, Manual Station, Conventional Heat, Waterflow.

.2 Delayed Waterflow.

.3 Non-Latching Monitor.

.4 Supervisory.

.4 Input circuit wiring shall be supervised for open and ground faults.

.5 The input module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the

loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.7 The single input module shall be suitable for mounting on North American 2 1/2" (64 mm) deep 1 gang, 1 1/2" (38 mm) deep 4" square box with 1 gang cover.

.8 The input module shall be suitable for operation in the following environment:

.1 Temperature:32°F to 120°F (0°C to 49°C).

.2 Humidity: 0-93% RH, non-condensing.

.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.2 Dual Input Module

.1 The intelligent Dual Input Module shall provide two (2) supervised input circuits capable of a minimum of 4 personalities, each with a distinct operation.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The dual input module shall support the following circuit types:

.1 Alarm Latching, Manual Station, Conventional Heat, Waterflow.

.2 Delayed Waterflow.

.3 Non-Latching Monitor.

.4 Supervisory.

.4 Input circuit wiring shall be supervised for open and ground faults.

.5 The dual module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.6 The dual input module shall be suitable for mounting on North American 2 1/2" (64 mm) deep 1 gang, 1 1/2" (38 mm) deep 4" square box with 1 gang cover.

.7 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.8 The input module shall be suitable for operation in the following environment:

.1 Temperature:32°F to 120°F (0°C to 49°C).

.2 Humidity: 0-93% RH, non-condensing.

.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.3 Single Input Signal Module

.1 The intelligent Single Input Riser/Signal Module shall provide one supervised output circuit. The output circuit shall be suitable for any of the following operations:

.1 24 vdc, polarized audible and visible signal appliances.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 Input circuit wiring shall be supervised for open and ground faults.

.4 The signal module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.5 The signal module shall be suitable for mounting on North American 2 1/2" (64 mm) deep 1 gang, 1 1/2" (38 mm) deep 4" square boxes.

.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.7 The signal module shall be suitable for operation in the following environment:

.1 Temperature:32°F to 120°F (0°C to 49°C).

.2 Humidity: 0-93% RH, non-condensing.

.8 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.4 Control Relay Module

.1 The intelligent micro-processor based Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps at 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems.

.2 The position of the relay contact shall be confirmed by the system firmware.

.3 The control relay module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.4 The control relay module shall be suitable for mounting on North American 2 1/2" (64 mm) deep 1 gang, 1 1/2" (38 mm) deep 4" square box with 1 gang cover.

.5 The module shall be suitable for operation in the following environment:

.1 Temperature:32°F to 120°F (0°C to 49°C).

.2 Humidity: 0-93% RH, non-condensing.

.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.7 It shall be possible to address each module without the use of DIP switches. Devices using DIP switches for addressing shall not be acceptable.

.5 Universal Class A/B Module

.1 The intelligent Universal Class A/B Module shall be capable of a minimum of 15 distinct operations.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The Universal Class A/B module shall support the following circuit types:

.1 Two Class B or one Class A Initiating Device Circuits (IDC) capable of delayed waterflow alarm operation.

.2 One Class A or B Indicating Device (Signal) Appliance Circuit (IAC).

.3 One Class A or B Circuit for 2 wire Smoke Detectors (Verified or non-verified).

.4 One Form "C" (NO/NC) Dry Output Contact Relay.

.4 Input/Output circuit wiring shall be supervised for open and ground faults.

.5 The universal Class A/B module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.6 The control relay module shall be suitable for mounting on North American 2 1/2" (64 mm) deep 1 gang, 1 1/2" (38 mm) deep 4" square boxes.

.7 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.8 The universal Class A/B module shall be suitable for operation in the following environment:

.1 Temperature:32°F to 120°F (0°C to 49°C).

.2 Humidity: 0-93% RH, non-condensing.

.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

2.16 As-Built Floor Plans

.1 Fire alarm system floor plans complete with address and device names and exits: in glazed frame minimum size 600 x 600 mm at main floor entrance.

2.17 Ancillary Devices

.1 Remote relay unit to initiate fan shutdown: Notifier FRM-1, or Simplex equal.

2.18 Conduit

.1 Rigid galvanized steel shall be used for fire alarm system.

Part 3 Execution

3.1 Installation

.1 Install systems in accordance with CAN/ULC-S524.

.2 Install central control unit and connect to ac power supply, dc standby power.

.3 Install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts. Relocate existing detector bases to avoid grille locations, etc.

.5 Connect alarm circuits to main control panel.

.6 Connect signalling circuits to main control panel.

.7 Install end-of-line devices at end of alarm and signalling circuits as required.

.8 Install addressable modules for non-addressable heat detector and connect to new fire alarm control panel.

.9 Splices are not permitted.

.10 Utilize existing conduit system where practical.

.11 Provide new raceways, where required, cable and wiring to make interconnections to annunciator equipment and CCU, as required by equipment manufacturer.

.12 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.13 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.14 Supply and install visible address number labels on all detector and pull station bases.

.15 Device location/description wording as they will appear on main control panel and annunciator shall be reviewed by Contract Administrator at shop drawing stage.

.16 Cut, patch and paint walls, ceilings and floors as required to carry out work. Utilize qualified trades to perform this work. Restore to original condition.

3.2 Field Quality Control

.1 Perform tests in accordance with CAN/ULC-S537-M97.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm and ancillary devices.

.2 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.

.3 Addressable circuits system style DCLB:

.1 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open-circuit fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.3 Provide final PROM program re-burn for system incorporating program changes made during construction at no charge to City.

.4 The manufacturer or his authorized representative must perform tests in accordance with CAN/ULC-S537-M97.

.5 Provide a complete verification report on CFAA forms. The verifying technician must bear approval from CFAA (Canadian Fire Alarm Association).

.6 Manufacturer or his authorized representative to provide complete system verification.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS OF WORK

.1 Supply, install, commission, provide warranty and fully document a complete instrumentation and control (I&C) system as shown on the Drawings and as specified herein. The I&C system contains vendor component subsystems specified in this and other Sections of the Specification.

.2 Component subsystems of the I&C system will include, but are not limited to, the following:

- .1 Primary elements and transmitters
- .2 Final control elements
- .3 I&C field devices
- .4 I&C junction boxes and marshalling panels
- .5 Instrumentation cabling
- .6 Instrumentation power supplies
- .7 Conduit and cable tray

.3 The Contractor's responsibility also includes receiving, uncrating, examining for shortages or damage, assembling, field fitting, installing, mounting, wiring and testing of vendor supplied component subsystems.

.4 Where packaged, stand-alone control systems are supplied under other Divisions of this Specification, provide cabling to connect to the required remote monitoring and/or control functions. Provide end-to-end Commissioning of all required remote monitoring and/or control functions. Ensure the correct functionality of any equipment supplied under other Divisions of this Specification.

.5 Documentation referred to in 1.1.1 to include as a minimum:

- .1 Equipment descriptive data
- .2 Equipment installation, service manuals, O&M Manuals and recommended spare parts lists
- .3 Schematics and interconnection wiring diagrams sealed by a Professional Engineer registered in the Province of Manitoba.
- .4 Records of conductor identification, field terminals, changes, etc.
- .5 Instrumentation and control panel Shop Drawings, face layouts, schematics and point-to-point wiring diagrams sealed by a Professional Engineer registered in the Province of Manitoba.
- .6 Submit individual loop drawings based on the provide typicals
- .7 Records of as-built information for the complete instrumentation system.

.6 Documentation provided is formatted as follows:

.1 *Piping & Instrumentation Diagrams (P & IDS)* – depict the general intent of the control systems and are to be used as the governing document for the scope of Work.

.2 *Instrument Index* – an index of the detailed information for the devices shown on the P & IDs. The index lists the appropriate support documentation for the devices' supply and installation. The instrument index is the controlling document for the supply of materials.

.3 *Input/Output (I/O) Index* – an index of the control system I/O points shown on the P & IDs, giving the supporting documentation as per the instrument index.

.4 *Instrument Specification Sheet* – detail the relevant data for the supply of devices.

.5 *Instrument Loop Diagrams (ILDs)* – show typical interconnections and hook-up of devices. The Contractor is to reproduce an ILD for each device and record all relevant as-built information on each sheet for submission at the completion of the Work. Fill in all terminal and wiring numbers etc. from the Shop Drawings as they become available. A set of 'B' size (11 x 17) ACAD Drawings and associated files will be made available to the successful Contractor.

.6 *Location Drawings* – indicate in plan and/or elevation views where the instrument elements are physically located. These Drawings are provided to assist the Contractor in estimating the amount of cable and ducting required.

.7 *Standard Details* – provide a reference for installation, operation and other instructions pertinent to a particular device.

.8 *Detailed Specification* – lists qualifications, quality of materials and workmanship, and supplementary information.

.7 .Definitions

.1 .1 Interpret specialized terms not explicitly defined herein in accordance with ISA-S51.1, NEMA-ICS-1, ANSI/IEEE-Std-100, and The Communications Standard Dictionary, by Martin H. Weik.

.8 References

.1 This Specification contains references to the following Documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed Documents, the requirements of this Section prevail.

Reference	**Title**
API RP550-86	Manual on Installation of Refinery Instruments and Control Systems, Part I--Process Instrumentation and Control Sections 1 Through 13
ASME Section VII-89	Rules for Construction of Pressure Vessels
ASTM B68-86	Seamless Copper Tube
ASTM D883-89	Terms Relating to Plastics
IEEE 100-88	Dictionary of Electrical and Electronic Terms
ISA RP7.1-56	Pneumatic Control Circuit Pressure Test
ISA RP12.6-87	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations

ISA S5.4-76	Instrument Loop Diagrams
ISA S18.1-79	Annunciator Sequences and Specifications
ISA S51.1-79	Process Instrumentation Terminology
NEMA 250-85	Enclosures for Industrial Controls and Systems
NEMA ICS 1-88	General Standards for Industrial Control and Systems
NEMA ICS 2-88	Industrial Control Devices, Controllers, and Assemblies
NFPA 70-90	National Electrical Code (NEC)
SAMA PMC 17-10-63	Bushings and Wells for Temperature Sensing Elements
UBC-88	Uniform Building Code
UL 1012-89	Power Supplies
UL 94-80	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Weik, Martin H. Communications Standard Dictionary, Van Nostrand Reinhold Co., 1983

.9 Related Work:

.1 Mechanical

.2 Electrical

.10 Qualifications

.1 The instrumentation Subcontractor shall be a firm normally engaged and fully competent in the type of Work described in this Section of the Specification. The firm shall have been continuously and successfully engaged in this business for at least five years.

.2 Qualified journeyman instrument mechanics that are familiar with the devices being installed shall perform all instrument hook-ups, calibrations, and checkouts.

.3 Qualified journeyman electricians shall perform all control wiring installation and connections.

.11 Codes, Rules, Permits & Fees

.1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this Work.

.2 Comply with all rules of the Electrical Safety Act of the Province, CSA Standards, the ULC and the applicable building codes, whether specifically shown on Drawings or not.

.3 Give all required notices, submit Drawings, obtain all permits, licenses and certificates and pay all fees required for this Work.

.4 Furnish a certificate of final inspection and approvals from an inspection authority to the Contract Administrator.

.12 Standards of Workmanship

.1 Execute all Work in a manner, which will result in the completed installation presenting an acceptable appearance, to a level of quality defined in the general conditions of this Specification.

.2 Employ a competent supervisor and all necessary licensed tradesmen to complete the Work in the required time.

.3 Arrange and install products to fit properly into designated building spaces.

.4 Install products in accordance with the recommendations and ratings of the product manufacturers.

.13 Contract Drawings and Specifications

.1 Refer to Division 1.

.2 Supply and install all items and accessories specified by the Drawings or the Specification in the quality and quantity required. Perform all operations as designated by the Specification according to the methods prescribed, complete with all necessary labour and incidentals.

.3 Treat any item or subject omitted from this Division's Specifications or Drawings, but which is mentioned or reasonably specified in other Divisions' Specifications or Drawings and pertains to the instrumentation and control system, as being integral to the overall system. Provide such specified items or subjects.

.4 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

.5 If discrepancies or omissions in the Drawings or Specifications are found, or if intent or meaning is not clear, consult the Contract Administrator for clarification before submitting Bid in accordance with B4.

.6 The responsibility to determine which Division provides various products and Work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of Specifications.

1.2 EQUIPMENT

.1 Receiving, Storing, and Protection of Components during Construction

.1 Examine each component upon delivery to Site. Report all damage noted to the Contract Administrator prior to accepting or rejecting delivery. All instrumentation primary elements, control components, panels, etc. shall be placed in a secure, dry, heated storage building. Maintain the space temperature above 10°C and the space relative humidity below 50 percent.

.2 Perform a preliminary examination upon delivery to ensure that:

.1 All instrumentation and control components supplied for this project under this Section of the Specification comply with the requirements stated in the instrument Specification sheets.

.2 All instrumentation and control components supplied under other Sections of this Specification, to be connected to instrumentation and control components supplied under this Section of the Specification, comply with the requirements stated in the Contract Documents.

.3 Itemize all non-conformities noted above and forward them to the Contract Administrator. Any delays in construction resulting from the

delivery to Site of non-conforming instrumentation and control components shall be borne by the Contractor.

.4 Do not install primary elements or other sensitive equipment until construction is sufficiently completed to provide an "operating condition" environment. Notify the Contract Administrator prior to installing any equipment of this type.

.5 Ensure that covers where required are properly installed on all equipment. Provide all covers, padding, guards, etc. as required to guard any equipment against damage.

.6 Return all damaged equipment to the factory for total corrective repairs. If deemed necessary by the Contract Administrator, the damaged equipment shall be replaced with new product. The Contractor shall bear any costs due to construction delays resulting from the delay in delivery of acceptable equipment.

1.3 SITE

.1 Classification of Plant Areas

.1 Refer to Division 26

1.4 DOCUMENTATION

.1 Submittals

.1 Submit Shop Drawings for all products supplied by this Division.

.2 Operations and Maintenance Manuals

.1 Refer to Division 1 for general O&M Manual submittal information.

.2 In addition to the requirements specified in Division 1, provide the following information:

.1 Table of Contents - Arrange contents sequentially by systems under Section numbers. Label tabs of dividers between each to match section numbers in the Table of Contents.

.2 Systems Descriptions - A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.

.3 Maintenance and operating instructions for all equipment and controls – These operating instructions need not be manufacturer's data but may be typewritten instructions in simple language to guide the City in the proper operation and maintenance of this installation.

.4 A copy of all wiring diagrams complete with wire coding.

.5 Include type and accuracy of instruments used.

.6 Set of final reviewed Shop Drawings.

.7 Provide a tabulated list of all consumables utilized (fuses, lamps, etc.) indicating where used, type, rating and reorder details.

.3 Construction Record Drawings

.1 Maintain on-site a complete set of Construction Record Drawings as listed in Division 1 of this Specification.

.2 In addition to the requirements as stated in Division 1, record the following information on the Drawings:

.1 All changes, alterations or additions

.2 All instrumentation cable and control tubing

.3 All changes to the numbers and location of outlets, motors, panels and end devices that may occur during the course of the Work.

.3 Before requesting the Certificate of Total Performance, make any necessary final corrections to the Drawings, sign each print as a certification of accuracy and deliver all sets to the Contract Administrator for approval.

Part 2 Products

2.1 GENERAL

.1 Refer to the requirements of Division 1

.2 Selected Products:

.1 Provide products and materials that are new and free from all defects.

.2 The design have been based on the use of the first named product where multiple products have been listed.

.3 Alternate Products

.1 Refer to Division 1 for consideration of alternate products.

.2 Alternate products and materials to those specified will only be considered by the Contract Administrator if they are shown in the Bid as a material variation, and if they are submitted with an appropriate price adjustment. The Contract Administrator will reserve the right to accept or reject any alternative without explanation.

.3 The alternate submission shall provide sufficient information to enable the Contract dministrator to determine whether the alternate is acceptable or unacceptable.

.4 Provide complete information on required revisions to other Work and products to accommodate each alternate product.

.5 The Contractor assumes full responsibility when providing alternate products or materials that all space, weight, connections, power and wiring requirements etc. are considered and compensated for. Any costs incurred for additional components, changes to other services, structural or space requirements, layouts and plans, etc. that may arise from the use of the alternate shall be borne by the Contractor.

.4 Quality of Products

.1 All products provided to be CSA and ULC approved where applicable.

.2 If products specified are not CSA approved, obtain approval of the relevant provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Refer to Division 1 of this Specification for further information.

.5 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the Specification, uniformity of manufacture to be maintained for similar products throughout the Work.

.6 Product Finishes

.1 Products to be manufacturers' standard finish. Where special finishes are specified refer to Division 9 for details on quality and workmanship of the finishes.

.7 Use of Products During Construction

.1 Any equipment used for temporary or construction purposes is to be approved by the Contract Administrator. Clean and restore to "as new" condition all equipment prior to the time of Substantial Performance.

2.2 INSTRUMENTATION

.1 General

.1 Instruments to be suitable for the environmental conditions in which they are to be installed.

.2 Determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation.

.3 Provide power surge protection, heating cables and devices to protect instruments, equipment and lines from being functionally impaired or damaged by power surges or environmental conditions such as moisture or freezing.

2.3 IDENTIFICATION

.1 Refer to Division 26 for general identification requirements. Provide lamicoid nameplates with 6 mm black lettering on white background. Identify the loop tag number (where applicable) and the device name, function, and instrument range or setpoint value on the nameplate.

.2 Where it is not possible to attach a lamicoid nameplate to a field instrument component, provide the component with a stainless steel metal tag firmly wired to the device and identified with the loop tag number.

.3 Identify all wires where they terminate at the marshalling panels, junction boxes and field devices with a heat shrink sleeve with machine printed labeling.

.4 Clearly mark all panels, pull boxes, junction boxes, etc. to indicate the nature of service.

.5 Provide neatly typed circuit directories for panel power distribution systems to indicate loops or devices powered by the circuit and the fuse size.

.6 Identify all exposed control conduits at all pull box locations, where the conduits enter or leave a room, and 13 m on centre throughout the room. This shall apply to conduits above removable ceilings. Use Thomas & Betts TY-RAP 5532-M labels conduit identification.

.7 For direct current wiring use black for positive and white for negative.

.8 For thermistor wiring to motors use red and blue coloured, insulated wire.

Part 3 Execution

3.1 SITE EXAMINATION

.1 Refer to the requirements of Division 1.

.2 No additional compensation will be given for extra Work due to existing conditions that a Site examination prior to Bid should have disclosed.

3.2 COORDINATION WITH OTHER DIVISIONS

.1 Examine the Drawings and Specifications of all Divisions and become fully familiar the Work. Before commencing Work, obtain a ruling from the Contract Administrator on any conflicting issues between Divisions. No compensation will be made for any costs arising from conflict not identified before Work has commenced.

.2 Coordinate the Work to be performed under this Section of the Specification with all Divisions installing equipment to ensure that there are no conflicts.

.3 Install anchors, bolts, pipe sleeves, hanger inserts, etc. required in ample time to prevent delays to other Division's installation Work.

.4 Lay out the Work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural Drawings take precedence over electrical Drawings regarding locations of walls, doors, and equipment.

.5 Structural members shall not be cut without prior approval of the Contract Administrator.

.6 Examine previously constructed Work and notify the Contract Administrator of any conditions, which prejudice the proper completion of this Work.

3.3 PRODUCT HANDLING

.1 Use all means necessary to protect the products included in this Division before, during and after installation, and to protect products and installed Work of all other trades.

.2 Any damage to the products and/or installed Work shall be repaired or replaced by the Contractor at no additional cost to the City and to the approval of the Contract Administrator.

.3 Remove advertising labels from all products installed that have such labels attached. Identification or CSA labels are not to be removed.

.4 Remove dirt, rubbish, grease, etc. resulting from Work performed under this Division of the Contract from all surfaces.

3.4 SEPARATION OF SERVICES

.1 Maintain separation between the electrical wiring system, piping, ductwork, and the instrumentation cables so that each system is isolated (except at approved connections to such systems) to prevent galvanic corrosion. In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is unacceptable.

.2 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings are not to be used for the support of wiring.

.3 Classifications of Circuits

.1 The circuit categorization shall of first priority follow Canadian Electrical Code with respect to separation for electrical safety and the following shall apply with respect to electro-magnetic compatibility:

Very Noisy	High voltage circuits and their associated grounding
	High current (>200 A) LV circuits.
	Harmonic-rich LV circuits
	DC circuits: un-suppressed or above 50 V
Noisy	Low current class two (2) circuits
	Medium power pulsed or radio frequency circuits
Indifferent	ELV digital status circuits
	Intrinsically safe circuits
	Telecommunications circuits
	Fire alarm and emergency lighting circuits (note that some fire alarm circuits may fall into the category of signal circuits).
	Any other emergency, shutdown, or high integrity circuit (e.g. toxic gas alarm).
Sensitive	Analogue signal circuits
	Data communication circuits
Very Sensitive	Low level voltage and current signals (e.g. from instrument sensors).

.4 Separation of Circuits

.1 This Section relates to the running of cables carrying differing types of circuit in close proximity to one another and to other services. Sensitive circuits shall normally be run in overall shielded cable. Very sensitive circuits shall normally be run in individually twisted pair shielded cable.

.2 For cables sharing the same support/containment system, the following shall provide guidance to minimize extraneous interference.

Segregation between circuits	**Very Noisy**	**Noisy**	**Indifferent**	**Sensitive**	**Very Sensitive**
Very Noisy	Thermal grouping as per CE Code	150 mm	300 mm	300 mm	300 mm
Noisy	150 mm	Thermal grouping as per CE Code	150 mm	150 mm	150 mm
Indifferent	300 mm	150 mm	Separation of circuit types.	100 mm	100 mm
Sensitive	300 mm	150 mm	100 mm	Touching	50 mm
Very Sensitive	300 mm	150 mm	100 mm	50 mm	Touching

3.5 WIRE AND CABLE

.1 Refer Division 26

3.6 EQUIPMENT CONNECTIONS

.1 Prior to the connection of signal wiring to process control and instrumentation devices, check the device voltage rating and polarity for compatibility with the corresponding loop and/or schematic diagram. Where device and circuit characteristics are found to be incompatible, the connections are not to be made. Report the condition immediately to the Contract Administrator.

.2 All control wiring diagrams illustrate typical control circuits applicable to the type of equipment specified. Control circuits may vary with different manufacturers equipment. Verify all control circuits with the manufacturers of the equipment and make any corrections to the control wiring diagrams that may be required.

.3 Provide power disconnect terminals in the marshalling panels for all devices and PLC/DCS input/outputs sourced from the panel. Provide local power disconnect switches for all 120VAC power instruments. Mount adjacent to the instrument.

.4 Provide a disconnecting means in the cable connecting each ultrasonic transponder to the transmitter. This disconnect shall consist of a terminal strip in a local water proof junction box.

3.7 WIRING TO EQUIPMENT SUPPLIED BY OTHER DIVISIONS

.1 Equipment supplied by the City or by other Divisions, that have external or field mounted control devices, are to be installed, wired and commissioned by this Division.

3.8 ACCESS PANELS

.1 Provide access panels where instrumentation and control system junction boxes are concealed. Panels to be of adequate size for servicing of the concealed junction box and complete with necessary frames and hinged doors held closed with captive fasteners. The type and size of panels are to be coordinated with the Contract Administrator.

.2 In removable ceiling areas provide markers on ceiling tile to locate equipment requiring access. Use a 25 mm diameter blue circle painted on the access panel to indicate that it is for instrumentation and control system access.

3.9 Instrument Mounting Stands

.1 Supply and install instrumentation mounting stands as required. Stands are to be either floor or wall mounted. The mounting stands are to be fabricated from aluminum or galvanized steel.

.2 Supply and install protective drip shields for any exterior stand-mounted instrumentation equipment. Drip shields are to extend 50 mm past the front and side faces of the equipment. Drip shields are to be fabricated from aluminum.

3.10 SEALING OF WALL AND FLOOR OPENINGS

.1 Seal all conduit and cable entries passing through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade.

.2 Seal openings after all wiring entries have been completed.

.3 Sealing material shall be fire resistant and shall not contain any compounds that could chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations, if required, are to be sealed. Submit shop drawing for rated assembly prior to installation of fire stop.

3.11 SLEEVES

.1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits passing through walls, partitions, ceilings, floors, etc.

.2 For walls, partitions and ceilings the ends shall be flush with the finish on both sides. For floors the ends shall extend 100 mm above finished floor level.

.3 Fill the space between the sleeve and the conduit with fire stop material and caulk around the top and bottom with approved permanently resilient, non-flammable and weatherproof silicone base compound. Ensure that the seal is compatible with the floor and ceiling finishes.

.4 Locate the sleeves and position exactly prior to construction of the walls and floors.

.5 Failure to comply with the above requirements shall be remedied at the Contractor's expense.

3.12 CONNECTIONS TO MECHANICAL, ELECTRICAL AND EXISTING SYSTEMS

.1 .1 Refer to Division 26 for the required tie-in procedures.

3.13 TAGGING STANDARDS FOR DEVICES AND WIRING

.1 Tag all devices, wires, and I/O using the assigned loop, equipment, or device tag name. Where tag naming and numbering is not specified, the Contract Administrator will provide naming and numbering that is consistent with the plant naming conventions.

3.14 TESTING OF INSTRUMENTATION LOOPS

.1 After all devices within a loop have been connected, check the loop for correct functioning and interaction with other loops, where applicable. Provide written notice to the Contract Administrator when the loops are going to be tested so that the tests may be witnessed at the Contract Administrator's discretion.

.2 Check the operation of final control elements such as solenoid valves, actuators, etc. by manual control before checking with automatic control.

.3 Check and simulate all alarms and shutdown functions.

.4 Verify the status of all points connected or accessible to the Distributed Control System.

.5 Test all tubing for leaks in compliance with ISA RP7.1. Isolate all instruments when tubing is being tested to protect against over pressure.

.6 Perform tests and record results on the test data forms that are included in this Section. Develop additional and/or more detailed test forms as necessary to suit more complex instrumentation.

.7 Sign and date all test reports. Submit the test reports to the Contract Administrator within five Business Days of testing.

.8 Coordinate and cooperate with City staff while they verify the Distributed Control System I/O.

3.15 CALIBRATION

.1 Instruments are to be factory pre-calibrated. Verify calibration after installation for all instruments installed under these Specifications. Provide a printed record of the factory calibration parameters for "smart" devices.

.2 Prior to calibration, completely program all "smart" transmitters including entries of the appropriate range and tag number. Provide a printed record of smart device serial numbers against their assigned tag number with all programmed parameters.

.3 Instruments to be set up and calibrated by an accredited instrument technician working under the approval of the instrument Manufacturer.

.4 Calibrate all instruments to an accuracy of 0.5 percent of full range, or to the manufacturer's stated accuracy of the instrument whenever an accuracy of 0.5 percent is not achievable.

.5 Prior to instrument installation perform the following applicable calibration for each instrument and its associated signal conditioning equipment:

.1 Calibrate all inline flow meters by a draw-down test

.2 Calibrate all density meters by lab samples

.3 Calibrate all vacuum and pressure instruments by manometer or accurate test instrument and hand test pump

.4 Calibrate gas detectors using standard gas sample

.5 Calibrate temperature instruments against a standard lab thermometer.

.6 Calibrate online analyzers with known samples.

3.16 COMMISSIONING

.1 Refer to the requirements of Division 1 for additional requirements.

.2 Inspections

.1 Provide two weeks' written notice to the Contract Administrator prior to energizing any system to allow for inspection by the Contract Administrator of the following:

.1 Proper mounting

.2 Proper connections

.2 During Commissioning, demonstrate to the Contract Administrator proper calibration and correct operation of instruments and gauges

.3 Commissioning of the instrumentation and control system to include but not be limited to the following.

.1 Verify installation of components, wiring connections and piping connections.

.2 Supervise wiring continuity and pipe leak tests.

.3 Verify instrument calibration and provide written report.

.4 Function check and adjust the instruments and control equipment under operational conditions.

.5 Coordinate manufacturer’s service personnel as required for complete system testing.

.6 Instruct plant personnel in correct method of instruments and control equipment operation.

.7 Direct plant personnel at hand-over as to final adjustment of the system for correct plant operation.

.8 Ensure that the Manufacturer’s representatives cooperate to complete the Work of this Section.

.9 Verify signal levels and wiring connections to all instrumentation and control equipment.

.10 Coordinate and cooperate with City staff to commission the Distributed Control System I/O points.

3.17 TRAINING

.1 Provide training, as described in detail in Division 1, in the proper operation and maintenance of all control devices, control valves, and ancillary instrumentation described under this Division of the Specification.

3.18 TEST FORMS

Form No.	Title
.1 ITR	Instrument Test Report
.2 LCR	Loop Check Report

LOOP CHECK REPORT

CHECKED OUT OK

NOT APPLICABLE

FURTHER ACTION REQUIRED

	INSTRUMENT TAG NO.								
LOOP NO. _____ SHEET NO. _____ P & I DWG. NO. _____									
INSTALLATION COMPLETE									
Primary Element									
Impulse Lines									
Block and Drain Valves									
Air Supply/Filter/Reg.									
Wiring									
Tracing/Insulation/Housing									
Mounting and Location									
PLC/SCADA I/O & Status									
CALIBRATED									
Impulse Lines Press. Tested									
LOOP CHECKED									
Element To Receiver									
X Mtr. to Receiver									
X Mtr./Trans. to Receiver									
X Mtr./Trans. to Switches									
Switches to Annunciator									
Interlocking Circuit									
Controller to Valve									
Controller Action D or R									

REMARKS:

READY FOR START-UP

DATE: _____

Installed by: _____

Checked by: _____

INSTRUMENT TEST REPORT

SYSTEM: _____

SERVICE: _____ TAG NO._____

LOCATION: _____ _____

MAKE: _____ MODEL: _____

SERIAL NO.: _____ CSA: _____

ELEMENT: _____ RANGE: _____

DESIGN SETTING/RANGE: _____ CONTACT TO: _____ ON: _____

SIGNAL IN:_____ OUT:_____ ASSOCIATED INSTRUMENT: _____

INSTRUMENT CONDITION: _____ CONFORM TO SPEC: _____

PROJECT NO.:_____ DATA SHEET: _____

	TEST 1				**TEST 2**			
TEST METHOD								
	INPUT		**OUTPUT**		**INPUT**		**OUTPUT**	
PROCESS	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**
TEST POINT 1								
TEST POINT 2								
TEST POINT 3								
TEST POINT 4								
TEST POINT 5								
COMMENTS								
GRAPHS								

TESTED BY: _____ CHECKED BY: _____
DATE: _____ DATE: _____

Part 1 General

1.1 REFERENCES - GENERAL

.1 Suppliers, Equipment, Products, and Execution must meet all requirements detailed in Section 29 05 00.

.2 Local control stations shall be supplied to house local control switches, push buttons and indictor lights associated with field devices (valves, drives etc). The control stations shall be located in close proximity to their associated devices. Where a group of devices are located within close proximity to each other, the local controls may be combined into a single common local control panel. Line of site must be maintained between all devices and the respective local controls.

Part 2 Products

2.1 GENERAL

.1 Unless otherwise specified, provide outside finishes on all enclosures in ANSI 61 Grey as specified in Division 9.

.2 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

2.2 ENCLOSURES

.1 Provide Electrical EEMAC Type 1A gasketted enclosures in MCC rooms and control rooms.

.2 All enclosures for mounting outside of MCC rooms and control rooms to be EEMAC Type 4, watertight except where otherwise specified.

.3 Provide EEMAC 7/3R enclosures for equipment in and around classified areas such as sumps.

.4 Enclosures for certain equipment in corrosive atmospheres to be EEMAC 4X approved for the classification (e.g. chemical cleaning).

.5 Enclosures for mounting field control indicator lamps and switches in unclassified areas to be Allen Bradley model 800T die cast enclosures.

.6 Enclosures for mounting field control indicator lamps and switches in Class 1 areas to be Allen Bradley model 800H cast aluminum enclosures.

2.3 PANEL ENCLOSURES

.1 Fabricate panel enclosures from 11 gauge steel panels complete with necessary stiffening to form a rigid free-standing lineup. The structures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors. Provide removable top and bottom cable entry plates.

.2 Provide panels with front access only. Doors shall be key lockable and fitted with 3-point heavy duty latching assemblies. Provide a continuous piano hinge and a pneumatic hold open device on each door.

.3 Finish the interior of the enclosure with white paint. Provide a switched fluorescent light fixture and 120 VAC duplex convenience receptacle inside the enclosure.

2.4 MARSHALING AND CONTROL PANELS

.1 Supply, fabricate, checkout, layout, document and deliver to Site fully equipped and functional panels**.**

.2 Supply all components contained on or within the panels fully wired under this Section of the Specification.

.3 The selection of all accessories, materials and methods for fabrication not covered by this Specification, but which are necessary to complete the fabrication of the control panels, is the responsibility of the panel fabricator.

.4 Fans and filters shall be installed to pressurize all control panels thus discouraging dust accumulation and providing air purging for temperature and corrosion control.

.5 Marshalling and control panels shall be adequately sized to facilitate a professional, uncluttered arrangement. Provide adequate internal and external space to accommodate a 20 percent increase in each type of component used.

.6 Control and marshalling panel layouts and wiring diagrams are to be provided by the Contractor as Shop Drawings.

2.5 WIRING AND ACCESSORIES

.1 Provide wiring inside the panels according to the following Specifications:

- .1 Control wiring to be a minimum of #16 AWG tinned stranded copper; insulation rated at 600 V.
- .2 Wiring for power distribution shall be a minimum of #14 AWG tinned stranded copper; insulation rated at 600 V.
- .3 Install cables in accordance with the requirements of Division 16.

.2 Tag each wire at both ends with a heat shrink sleeve that is machine printed. Allow approximately 20 mm of wire insulation between the tag and the bare wire.

.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.4 Run all wiring in enclosed plastic wireways such as Panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed 40 percent of the cross sectional area of the wire way.

.5 Provide a minimum clearance of 50 mm between wire ways and any point of wire termination.

.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the panels. Identify each terminal strip with a terminal strip number, defined as follows:

.1 Wire identification to use the connected field device tag name with the wire's corresponding end device terminal number appended to it.

.2 Identify every joint and/or terminal of the above wire run with the same identifier until the wire meets another tagged device, at which point the wire identifier will change to use the new device name and terminal number.

.3 For example, pressure transmitter S740-FIT located in the field has a 1 PR-TPSH cable connected to it. The cable runs through a junction box to a marshaling panel. The wire identifiers for the pair of wires would be S740-FIT all the way to the marshaling panel.

.4 Identify spare wires by using the cable tag, wire number and an “-SP” suffix.

.5 Arrange wiring on terminal blocks such that all internal panel wiring terminates on the inboard side of the terminal blocks and all external wiring terminates on the outboard side.

.7 Provide a 120 VAC panel power distribution system and a 24 VDC power distribution system in each panel. Provide 12 VAC power for the CCTV fiber converters as required. Provide a thermal magnetic circuit breaker on each main power circuit and a fused terminal block for each branched circuit off the main.

.8 Provide disconnect type terminal blocks Weidmuller WTR 4 series to isolate field wiring that is powered sourced from the panel. Provide a dedicated fused disconnect type terminal block to isolate each individual DCS input and output.

.9 Provide sufficient terminals so that not more than two wires are connected under the same terminal. Provide 20 percent spare terminal capacity at each terminal block assembly.

.10 Terminals shall be Weidmuller W Series color coded as follows:

Red = positive 24 VDC
Black = analog signal plus
White = analog signal common and VAC neutral
Grey = 120 VAC
Green = ground

.11 Provide nameplates for each device on or within the panels and enclosures. Nameplates shall be white lamicoid with black lettering, a minimum of 25 mm x 75 mm in size with up to three lines of 5 mm lettering. Securely fasten nameplates in and situate them in a visible location.

2.6 PANEL GROUNDING

.1 Provide a ground system for the instrumentation circuits, isolated from the main power system ground to each marshaling panel.

.2 Provide grounding lugs for each panel, suitable for termination of up to #2 AWG copper grounding conductor.

.3 Provide in each marshaling panel an isolated grounding bus bar 6 x 25 x 600 mm, equipped with necessary lugs for accepting two (2) #2 AWG grounding conductors.

.4 Firmly bond all panel-mounted devices on or within the panels to ground. Provide supplementary bonding conductors for backpanels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

Part 3 Execution

3.1 MOUNTING HEIGHTS

.1 Unless otherwise specified or a conflict exists, mount all panels, starters and disconnects 2000 mm to top of cover.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Division 1 and Division 26.

1.2 RELATED WORK

.1 Refer to Division 26

1.3 INSPECTION

.1 Provide adequate notice to the Contract Administrator so that all cable installations can be inspected prior to energizing equipment.

1.4 STANDARDS

.1 All wire and cable shall be CSA approved.

Part 2 Products

2.1 TWISTED PAIR SHIELDED CABLES (TPSH)

.1 TPSH shall be constructed as follows:

- .1 Two (2) copper conductors, stranded, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm
- .2 Insulated for 600 V, 90°C
- .3 100 percent coverage aluminum foil or tape shield
- .4 Separate bare stranded copper drain wire, minimum #18 AWG
- .5 Overall flame retardant PVC jacket to CSA-C22.2
- .6 The entire cable assembly to be suitable for pulling in conduit or laying in cable tray.
- .7 Shaw Type 1751-CSA or Beldon equivalent

.2 Where multi-conductor TPSH cables are called for, each pair shall be individually shielded, continuous number coded, and the cable assembly shall have an overall shield and overall flame retardant PVC jacket.

2.2 RTD AND MULTI CONDUCTOR SHIELDED CABLE

.1 RTD cables shall be CSA approved and shall be constructed as follows:

- .1 Three or more copper conductors, stranded, minimum # 18 AWG
- .2 PVC insulated for 600 V

.3 100 percent coverage aluminum foil or tape shield

.4 Separate bare stranded copper drain wire

.5 Overall flame retardant PVC jacket to CSA-C22.2

2.3 TECK CABLES

.1 As per Division 26

2.4 WIRE

.1 As per Division 26

Part 3 Execution

3.1 ANALOG SIGNALS

.1 Use TPSH cable for all low level analog signals such as 4-20 mA, pulse type circuits 24 VDC and under, and other signals of a similar nature.

.2 Use RTD cable for connections between RTDs and transmitters or control system RTD inputs.

3.2 DIGITAL SIGNALS

.1 Use TPSH cable for all low level input (24 V and below) and output signals to the control system.

3.3 INSTRUMENT POWER

.1 Use Teck cable or wire and conduit for power to instruments, for 120 V signals other than those mentioned above and as otherwise indicated on the Drawings. Use stranded wire and cable to supply power to instruments.

3.4 INSTALLATION

.1 Install instrumentation cables in conduit systems or in cable trays. Use a minimum of 300 mm and a maximum of 1000 mm length of liquid tight flexible conduit to connect the field sensors to the conduit.

.2 Where non-armoured instrumentation cables are installed in cable trays, provide barriers in the tray to separate instrumentation cables from power cables.

.3 At each end of the run leave sufficient cable length for termination.

.4 Do not make splices in any of the instrumentation cable runs.

.5 Cable shields shall be terminated on insulated terminals and carried through to the extent of the cable.

.6 Ground cable shields at one end only. Unless otherwise specified, ground the shields at the marshalling panel.

.7 Protect all conductors against moisture during and after installation.

3.5 CONDUCTOR TERMINATIONS

.1 All equipment supplied shall be equipped with terminal blocks to accept conductor connections.

.2 Instrumentation conductors, where terminated at equipment terminals other than clamping type terminal blocks, shall be equipped with Burndy-YAE-2 or STA-KON, self-insulated, locking type terminators, sized as required to fit conductors and screw terminals.

3.6 TESTING

.1 Test all conductors for opens, shorts, or grounds. Resistance values shall not be less than those recommended by the cable manufacturer.

.2 Test all fiber optic cables and terminations for signal integrity and conformity to manufacturer's specifications. Submit results to the City.

3.7 IDENTIFICATION

.1 Identify all instrumentation cables.

.2 Identify each conductor with wire numbers using a machine printed Raychem TMS heat shrink wire marker or approved equal in accordance with B6.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 The Work includes the provision of all instrument air supply and transmission devices.

.2 Refer to Section 290500 for general instrumentation and control requirements related to instrument air supply and transmission.

Part 2 Products

2.1 PNEUMATIC AND PROCESS CONNECTIONS

.1 Pipe, fittings, valves, tubing, tube fittings, etc. required under this Section of the Contract to be Swagelok and rated for the service in which they are to be employed.

.2 Except for the last 300 mm, tubing and fittings to be made of stainless steel. For the last 300 mm (nominal), use reinforced neoprene tubing with a pressure rating of at least 1000 kPa.

.3 Dimensions:

.1 Process connections - 12 mm (nominal) O.D. tubing

.2 Output/signal - 10 mm (nominal) O.D. tubing

.3 Air supply - 12 mm pipe (nominal) to isolation valves and 10 mm O.D. tubing (nominal) from isolation valves to end devices (e.g. valves).

.4 Provide a continuous support channel or raceway for all tubing.

2.2 AIR SETS

.1 Provide all pneumatic actuator assemblies with an air set.

.2 Provide Fisher 67FR air sets unless specified otherwise in the Instrument Specification Sheets of Section 17701.

.3 Air set to be complete with filter regulator and output pressure gauge.

.4 Filter rating shall be 40 um or less as called for in actuator manufacturer’s specification.

2.3 SOLENOID VALVES

.1 Provide Asco Redhat type solenoid valves unless specified otherwise in the Instrument Specification Sheets of Section 17701.

.2 Solenoid enclosures to be minimum EEMAC 4; corrosive areas require EEMAC 4X and hazardous areas require EEMAC Type 9. Refer to Division 16 for area classifications.

.3 Provide manual overrides on coils when solenoid is used to actuate a valve.

.4 Standard coil voltage: 120 VAC

.5 Pipe size: 3-way valve - 6mm; 4-way valve – 10 mm

.6 Maximum operating pressure: 850 kPa instrument air

.7 Minimum operating pressure: 20 kPa instrument air

Part 3 Execution

3.1 TUBING AND FITTING INSTALLATION

.1 Group instruments logically together. Orient instrument air and process connection isolation valves to provide consistent handle indication of normal open/closed status.

.2 Complete final location of field instruments to provide sufficient clearance for access to all maintenance settings, to provide unobstructed viewing of instrument indicators and to permit instrument calibration and maintenance during normal operation of the site.

.3 Slope tubing installations 20 mm per 2 m of run down to process connection.

.4 Support tubing in channel or raceway if exposed or in close proximity to rotating equipment or high traffic areas. Otherwise do not exceed 1 m between tubing supports.

.5 All turns shall have a minimum bending radius of 50 mm.

.6 Avoid non-terminal connections in tubing runs.

.7 Use teflon tape on all threaded fittings. Do not apply tape on the first two threads.

.8 Complete the final 300 mm (nominal) of air tubing to instruments or control valves installed in process equipment with flexible reinforced neoprene hose. Support the tubing at the hose connection. Tubing shall terminate with fittings or 90° bends, to allow removal of neoprene tubing without disturbing the fixed tubing mounting. Locate the hose connection to facilitate unrestricted removal of the instrument or control valve and to minimize transmission of process equipment vibration into the tubing.

.9 Air tubing with out door runs to be insulated against cold.

.10 Ensure air supply is blown down and free from debris before connecting end devices.

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

.1 Equipment, products and execution must meet all requirements detailed in Section 29 50 00.

Part 2 Products

2.1 TRANSMITTERS AND INDICATORS

.1 Provide transmitters and indicators.

.2 Transmitters shall have adequate power output to drive all devices associated with the signal loop. Provide signal boosters as required to achieve adequate signal strength or to isolate the signal.

.3 All transmitters to have local indication scaled in engineering units as specified in the engineering Specifications. Provide a lamicoid label indicating the calibrated range and engineering units and mount adjacent to the transmitter. Mount the transmitter so the indicator is visible by operations personnel.

.4 Provide remote indicators similar to Action Instruments model V560 for use in unclassified areas. Action Instruments model V560-EP for use in Class 1 areas is acceptable.

.5 Where the loop specification calls for a transmitter and an indicator to be mounted in the same panel, an indicating transmitter may be considered acceptable, provided the indicator is normally visible from outside the enclosure.

.6 Where available as an option, the transmitter shall be supplied with an isolated fault contact.

.7 Standard of acceptance for instrumentation shall be as follows:

.1 Pressure Transmitters: Rosemount Model 3051, ABB, or Foxboro complete with stainless steel two and three-valve manifolds as manufactured by Anderson Greenwood

.2 Pressure Gauges: Ashcroft, H.O. Trerice, Budenberg.

.3 Temperature Transmitters (RTD): Rosemount, ABB, Foxboro

Part 3 EXECUTION

3.1 References - General

.1 Refer to Section 29 05 00.

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00

Part 2 Products

2.1 GENERAL

.1 Use normally closed contacts for alarm actuation. The contacts open to initiate the alarm.

.2 Use normally open contacts to control equipment. The contacts close to start the equipment.

.3 Contacts monitored by solid state equipment to be hermetically sealed and adequately rated for the connected load.

.4 Contacts monitored by electro-magnetic devices such as mechanical relays to be rated NEMA ICS 2, designation B300.

.5 Provide double barriers between switch elements and process fluids such that failure of one barrier will not permit process fluids into electrical enclosures.

.6 Switch electrical enclosures to be rated EEMAC 4, minimum.

.7 120 VAC switches to have a 4 A rating.

2.2 INDICATORS, PUSHBUTTONS AND SELECTOR SWITCHES

.1 All control indicator lamps, pushbutton switches, and selector switches in unclassified or non-corrosive areas to be Allen Bradley 800T or 800E series.

.2 All control indicator lamps, pushbutton switches, and selector switches in classified or corrosive (includes outdoors) areas to be Allen Bradley 800H series.

.3 All control indicator lamps shall be push-to-test type.

2.3 RELAYS

.1 The Quality and type of relays shall be based on Omron relays.

.2 120 VAC relays to be Model LY 4PDT, plug-in, complete with test button and operation indicator, and surge suppressor.

.3 24 VDC relays to be Model MY 2PDT plug-in, complete with test button and operation indicator, and surge suppressor diode.

.4 Time delay relays for behind panel mounting to be Model H3BA, 2PDT, plug-in, and programmable for sixteen (16) time ranges and four (4) operation modes.

.5 Time delay relays for flush panel mounting and operator accessible timing range modifications to be Model H5BR, SPDT, screw terminals, programmable for five (5) timing ranges and eight (8) operation modes, complete with digital display, module for time settings and flexible protective cover.

.6 Where the contact ratings of the relays listed are insufficient for the application select an appropriate type from an approved Manufacturer with the same quantity of contacts as was originally specified.

.7 Provide relay plug-in sockets for DIN mounting complete with stacked screw clamp terminals.

2.4 PROCESS SWITCHES

.1 Standard of acceptance for instrumentation shall be as follows:

.1 Thermal Flow Switches: Ifm, Weber
.2 Pressure Switches (Electronic): Ifm, United Electric
.3 Pressure Switches (Conventional): Ashcroft, United Electric, Barksdale.
.4 Conductivity Level Switches: Endress & Hauser
.5 Vibration Type Level Switches: Endress & Hauser
.6 Float Switches: Flygt, Consolidated Electric, Warwick, Magnetrol
.7 Capacitance Level Switches: Siemens, Endress & Hauser
.8 Admittance Level Switches: Magnetrol, Bestobell
.9 Temperature Switches: Ifm

Part 3 Execution

3.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

.1 Equipment, Products and Execution must meet all requirements detailed in Section 29 05 00.

Part 2 Products

2.1 MISCELLANEOUS PANEL DEVICES

.1 Pilot Lights

.1 Provide LED transformer type pilot lights for extended lamp life, oil tight, push to test, complete with appropriate colour lenses. Normal colours used are run=red, stop=green. Refer to Division 26 for additional information

.2 Terminals

.1 Provide strap screw type terminal blocks rated for 600 V.

.2 Identify each terminal block within an enclosure with a unique machine printed terminal block number. Cabinet chassis grounding terminal blocks to be identified by the electrical ground symbol.

.3 Connections to screw terminals to be locking fork tongue insulated crimp type wire connectors.

.4 Terminals to be Weidmuller or approved equal in accordance with B6.

.5 Provide a group of terminals for each of 120 VAC hot and neutral and 24 VDC positive and negative power. Distribution wiring to have a thermal magnetic circuit breaker upstream of all major blocks of loads, adequately sized to protect the connected load while not causing nuisance tripping.

.6 Provide Weidmuller disconnect type terminal blocks for each load or loop powered from the marshalling panels.

.3 Nameplates

.1 Refer to Section 29 05 00

2.2 SIGNAL CURRENT ISOLATOR

.1 Isolators shall be installed to provide galvanic isolation of milliampere transmission signals from transmitters with inadequately isolated output circuits.

.2 Isolator shall be housed in a NEMA 250, Type 4/7 conduit body and derive its operating power from the signal input circuit.

.3 Input and output signals shall be 4 to 20 mA, with an error not exceeding 0.1 percent of span. Input resistance will not exceed 550 ohms with an output load of 250 ohms.

.4 Approved manufacturers are Moore Industries, Weidmuller or Phoenix.

2.3 INTRINSIC SAFETY BARRIERS AND RELAYS

.1 Provide intrinsic safety barriers where required for two-wire transmitters of the active, isolating, loop powered type; MTL Type MT3042, Stahl 9005/01-252/100/00, P+F ZG series, or approved equal in accordance with B6.

.2 Provide dual type intrinsic safety barriers for process switches; MTL 787, Panalarm 201-BR2.

.3 Intrinsic safety relays to be Stahl, Gems, or Warrick.

Part 3 Execution

3.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Connection and termination of all new plant instrumentation, control system I/O, communications media and vendor packages to the existing Distributed Control System (DCS).

.2 The City will supply all DCS hardware expansion of the DCS to meet the new I/O requirements. Assist the City in the installation of the new hardaware.

.3 Start-up and Commissioning of the complete control system and associated field devices and wiring.

.4 Cooperate with Package Plant Vendors and City programming, maintenance and operations staff to interface, test and commission the interface between the DCS and the equipment installed under this Contract.

Part 2 Products

2.1 EXISTING DISTRIBUTED CONTROL SYSTEM

.1 General

.1 All new DCS equipment will be supplied by the City..

.2 City personnel will provide the DCS logic configuration.

2.2 SYSTEM INTEGRATION REQUIREMENTS

.1 Cooperate and coordinate activities with other Contractors, the City, and the Contract Administrator to facilitate installation, testing, validation, and Commissioning of all components and equipment required under the BNR upgrade.

.2 Supply, install, test and commission control panels for local operator controls as specified in this Division.

.3 The City will supply the required additional hardware components for the existing Bailey Infi-90 DCS system to meet the increased I/O requirements created under the plant expansion.

.4 All equipment testing and commissioning responsibilities must be carried out while at the same time maintaining the Plant DCS. Any equipment outage requirements are to be kept to a minimum and are to be scheduled with the Contract Administrator prior to implementation.

.5 Provide Contract Administrator minimum four (4) weeks notice of required DCS configuration for testing and commissioning.

.6 The City will require a minimum of four (4) weeks to install, test, and commission configuration changes.

Part 3 Execution

3.1 Performance – General

.1 Refer to Section 29 05 00

3.2 INSTALLATION

.1 Provide hardware in accordance with the foregoing requirements in sufficient quantity to satisfy the performance requirements defined in this and other Divisions of the Specification.

.2 Provide all necessary documentation to define the control system including details for all hardware.

.3 Commission and start up the system as defined herein.

.4 Provide all documentation and training as defined herein.

.5 Maintain existing plant operation during entire Construction Period. Refer to the requirements of Division 1.

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00

1.2 DCS I/O INDEX

.1 The following spreadsheet gives an itemized list of the new Distributed Control System inputs and outputs. It is intended to serve as an aid for determining the cabling requirements for the Work specified in this Division.

Part 2 Products

.1 Not used

Part 3 Execution

.1 Not used

NO.	REV. NO.	TAG NAME				DESCRIPTION		P&ID DRAWING	I/O SPECIFICATION						
		PCU	AREA	LOOP	DEVICE ID	FUNCTION	SERVICE		ENG. UNITS	SCALE LOW-HIGH	ALARMS		I/O POINT TYPE	I/O POINT NO.	PCU AREA
											LOW	HIGH			
001	00	MA	M	609	MN	Motor Start	M609 Air Handling Unit	A-D-P0004					DO		
002	00	MA	M	609	MM	Motor Running Status	M609 Air Handling Unit	A-D-P0004					DI		
003	00	MA	M	609	UF	VFD Fault	M609 Air Handling Unit	A-D-P0004					DI		
004	00	MA	M	609	YS	Computer Selected	M609 Air Handling Unit	A-D-P0004					DI		
005	00	MA	M	609	SC	Speed Control	M609 Air Handling Unit	A-D-P0004	%	0 to 100			AO		
006	00	MA	M	609	TC	Discharge Air Temperature	M609 Air Handling Unit	A-D-P0004	°C	-10 to 50			AO		
007	00	MA	M	609	DPT	Air Plenum Pressure	M609 Air Handling Unit	A-D-P0004	Pa	-50 to 50	20		AI		
008	00	MA	M	615	ZC	Position Control	Level 400 VAV Box	A-D-P0004	%	0 to 100			AO		
009	00	MA	M	615	ZT	Position Feedback	Level 400 VAV Box	A-D-P0004	%	0 to 100			AI		
010	00	MA	M	615	FT	Air Flow Transmitter	Level 400 VAV Box	A-D-P0004	lps				AI		
011	00	MA	M	616	ZC	Position Control	Dry Well Level 300 VAV Box	A-D-P0004	%	0 to 100			AO		
012	00	MA	M	616	ZT	Position Feedback	Dry Well Level 300 VAV Box	A-D-P0004	%	0 to 100			AI		
013	00	MA	M	616	FT	Air Flow Transmitter	Dry Well Level 300 VAV Box	A-D-P0004	lps				AI		
014	00	MA	M	617	ZC	Position Control	Dry Well Level 100 & 200 VAV Box	A-D-P0004	%	0 to 100			AO		
015	00	MA	M	617	ZT	Position Feedback	Dry Well Level 100 & 200 VAV Box	A-D-P0004	%	0 to 100			AI		
016	00	MA	M	617	FT	Air Flow Transmitter	Dry Well Level 100 & 200 VAV Box	A-D-P0004	lps				AI		
017	00	MA	M	618	TT	Space Temperature Transmitter	Electrical Room Level 400	A-D-P0004	°C	-10 to 50	5	38	AI		
018	00	MA	M	619	TT	Space Temperature Transmitter	Dry Well Level 300	A-D-P0004	°C	-10 to 50	5	38	AI		
019	00	MA	M	634	MN	Motor Start	L400 Supply Fan	A-D-P0004					DO		
020	00	MA	M	634	MM	Motor Running Status	L400 Supply Fan	A-D-P0004					DI		
021	00	MA	M	634	YS	Computer Selected	L400 Supply Fan	A-D-P0004					DI		
022	00	MA	M	635	ZSB	Position Close	L400 Supply Fan Inlet Damper	A-D-P0004					DI		
023	00	MA	M	606	MN	Motor Start	L300 Combustion Air Supply Fan	A-D-P0004					DO		
024	00	MA	M	606	MM	Motor Running Status	L300 Combustion Air Supply Fan	A-D-P0004					DI		
025	00	MA	M	606	YS	Computer Selected	L300 Comb. Air SF Inlet Damper	A-D-P0004					DI		
026	00	MA	M	606	ZSB	Position Close	L300 Comb. Air SF Inlet Damper	A-D-P0004					DI		
027	00	MA	M	632	ZC	Position Control	Building Pressure Relief	A-D-P0005	%	0 to 100			AO		
028	00	MA	M	632	ZT	Position Feedback	Building Pressure Relief	A-D-P0005	%	0 to 100			AI		
029	00	MA	M	613	PDT	Differential Pressure Transmitter	Dry Well Level 300 Pressure Control	A-D-P0005	Pa	-50 to 50	20		AI		
030	00	MA	M	610	MN	Motor Start	Wet Well Ventillation Exhaust Fan	A-D-P0005					DO		
031	00	MA	M	610	MM-1	Motor Running Status	Wet Well Ventillation Exhaust Fan	A-D-P0005					DI		
032	00	MA	M	610	MM-2	Motor Running Low Speed Light	Wet Well Ventillation Exhaust Fan	A-D-P0005					DO		
033	00	MA	M	610	MM-3	Motor Running High Speed Light	Wet Well Ventillation Exhaust Fan	A-D-P0005					DO		
034	00	MA	M	610	UF	VFD Fault	Wet Well Ventillation Exhaust Fan	A-D-P0005					DI		
035	00	MA	M	610	YS-1	Computer Selected	Wet Well Ventillation Exhaust Fan	A-D-P0005					DI		
036	00	MA	M	610	HS-2	Occupied Mode Selected	Wet Well Ventillation Exhaust Fan	A-D-P0005					DI		
037	00	MA	M	610	FS	Flow Switch	Wet Well Ventillation Exhaust Fan	A-D-P0005					DI		
038	00	MA	M	610	SC	Speed Control	Wet Well Ventillation Exhaust Fan	A-D-P0005	%	0 to 100			AO		
039	00	MA	M	636	TT	Temperature Transmitter	Wet Well Space Temperature	A-D-P0005	°C	-10 to 50	5	38	AI		
040	00	MA	M	620	MN	Motor Start	Generator Room Exhaust Fan	A-D-P0006					DO		
041	00	MA	M	620	MM	Motor Running Status	Generator Room Exhaust Fan	A-D-P0006					DI		
042	00	MA	M	620	UF	VFD Fault	Generator Room Exhaust Fan	A-D-P0006					DI		
043	00	MA	M	620	YS	Computer Selected	Generator Room Exhaust Fan	A-D-P0006					DI		
044	00	MA	M	620	SC	Speed Control	Generator Room Exhaust Fan	A-D-P0006	%	0 to 100			AO		
045	00	MA	M	621	ZSB	Position Close	Gen. Room Cooling Air Inlet Damper	A-D-P0006					DI		
046	00	MA	M	622	ZSB	Position Close	Gen. Room Cooling Air Outlet Damper	A-D-P0006					DI		
047	00	MA	M	002	MM	Generator Running Status	Standby Generator	A-D-P0006					DI		
048	00	MA	M	002	UF-1	Trouble Status	Standby Generator	A-D-P0006					DI		
049	00	MA	M	002	UF-2	Shutdown Alarm Status	Standby Generator	A-D-P0006					DI		
050	00	MA	M	623	ZC	Position Control	Gen. Cooling Exhaust Air Damper	A-D-P0006	%	0 to 100			AO		
051	00	MA	M	623	ZT	Position Feedback	Gen. Cooling Exhaust Air Damper	A-D-P0006	%	0 to 100			AI		
052	00	MA	M	624	ZC	Position Control	Gen. Cooling Recyle Air Damper	A-D-P0006	%	0 to 100			AO		
053	00	MA	M	624	ZT	Position Feedback	Gen. Cooling Recyle Air Damper	A-D-P0006	%	0 to 100			AI		
054	00	MA	M	625	ZD	Open Command	Gen. Cooling Inlet Air Damper	A-D-P0006					DO		
055	00	MA	M	625	ZSB	Position Close	Gen. Cooling Inlet Air Damper	A-D-P0006					DI		
056	00	MA	M	625	ZSD	Position Open	Gen. Cooling Inlet Air Damper	A-D-P0006					DI		

NO.	REV. NO.	TAG NAME				DESCRIPTION		P&ID DRAWING	I/O SPECIFICATION						PCU AREA
		PCU	AREA	LOOP	DEVICE ID	FUNCTION	SERVICE		ENG. UNITS	SCALE LOW-HIGH	ALARMS		I/O POINT TYPE	I/O POINT NO.	
											LOW	HIGH			
057	00	MA	M	639	TT	Temperature Transmitter	Generator Room Space Temperature	A-D-P0006	°C	-10 to 50	5	38	AI		
058	00	MA	M	920	GT	Methane Gas Transmitter	Wet Well Level 200	A-D-P0005	% LEL	0 to 100			AI		
059	00	MA	M	921	GT	H2S Gas Transmitter	Wet Well Level 200	A-D-P0005	ppm	0 to 50		20	AI		
060	00	MA	M	930	GT	Methane Gas Transmitter	Wet Well Level 300	A-D-P0005	% LEL	0 to 100			AI		
061	00	MA	M	931	GT	H2S Gas Transmitter	Wet Well Level 300	A-D-P0005	ppm	0 to 50		20	AI		
062	00	MA	M	932	GT	Methane Gas Transmitter	Dry Well Level 300	A-D-P0004	% LEL	0 to 100			AI		

Part 1 General

1.1 REFERENCES - GENERAL

.1 The Work includes the provision of all instrument specification sheets.

.2 Refer to Section 29 05 00

1.2 INSTRUMENT SPECIFICATION SHEETS

.1 Provide data sheets to itemize detailed as-built information regarding the Specification of instruments included as part of this Work for each instrument supplied. The data sheets already included in this Section list specific minimum requirements for particular applications.

.2 Use forms in accordance with the ISA Standard S20 as a template for the preparation of the specification sheets.

Part 2 Products

.1 Refer to the following specification sheets.

INSTRUMENT SPECIFICATION NUMBER:	**I-101**
DEVICE:	Level Switch
TAG:	Wet well, LSH and LSHH
TYPE:	Float Switch
SERVICE:	Waste water
ENCLOSURE:	Polypropylene float casing with preterminated signal cable
SIGNAL CABLE LENGTH:	20m
OUTPUT:	Relay contact resistive – 10A, 250V
MOUNTING:	Provide strain relief-type connectors to suspend float at desired location. Fabricate mounting brackets from 316 SS. Provide anti-sway rings to prevent sway in turbulent tanks.
MANUFACTURER AND MODEL:	Flygt ENM-10 Consolidated Electric Warwick Magnetrol
ACCESORIES:	Supply and install intrinsically safe barrier in DCS cabinet

INSTRUMENT SPECIFICATION NUMBER:	**I-102**
DEVICE:	Existing Liquid Level Transmitter
TAG:	Wet well level
TYPE:	Bubbler
SERVICE:	Waste Water
ACCESSORIES:	Stainless steel tubing and isolation ball valves.
NOTES:	Supply and install new tubing and isolation valves to allow manual selection between monitoring the level in the current chamber and monitoring the level in the second chamber.

INSTRUMENT SPECIFICATION NUMBER:	**I-103**
DEVICE:	Pressure Transmitter (Differential)
TAG:	M609-DP, M613-PDT
SERVICE:	M609-MAU discharge air pressure, LEVEL 300 air pressure
PROCESS CONNECTIONS:	1/8” NPT
RANGE:	-10 mbar to 10 mbar
INACCURACY:	±0.25% of span
OUTPUT:	4 to 20 mA DC into 500 OHM
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	Stainless steel wetted parts
ELECTRONIC ENCLOSURE:	EEMAC 4X
ACCESSORIES:	mounting bracket
MANUFACTURER AND MODEL:	Rosemount Type 951, or approved equal in accordance with B6
NOTES:	Mount in MAU control panel or in separate enclosure

INSTRUMENT SPECIFICATION NUMBER:	**I-104**
DEVICE:	Temperature
TAG:	M618-TT, M619-TT, M639-TT
SERVICE:	Space temperature
SPAN:	-10 to 50 degrees Celsius
SENSOR:	3 wire RTD, Pt 100
INACCURACY:	±0.1% of span
OUTPUT:	4 to 20 mA DC into 500 OHM
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	Stainless steel wetted parts
ELECTRONIC ENCLOSURE:	Universal head, aluminum alloy
ACCESSORIES:	mounting bracket
MANUFACTURER AND MODEL:	Rosemount 144 c/w RDT sensor

INSTRUMENT SPECIFICATION NUMBER:	**I-105**
DEVICE:	Methane Gas Detector
TAG:	M920-GIT, M930-GIT, M932-GIT
SERVICE:	Wet well and gas engine monitoring
RANGE:	0 to 100% LEL
SENSOR:	Infrared Hydrocarbon Gas Detector
INACCURACY:	±3% from 0 to 50% LEL, ±5% from 50 to 100% LEL
OUTPUT:	4 to 20 mA DC into 500 OHM
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	Stainless steel wetted parts
ELECTRONIC ENCLOSURE:	Explosion proof, stainless steel
CERTIFICATIONS:	CSA Class 1, Div 1, Groups C & D
ACCESSORIES:	mounting bracket
MOUNTING:	Mount near ceiling
CALIBRATION:	include calibration kit with 2 gas bottles, carrying case, regulator, calibration tubing and hook-up to weather baffle. Provide remote switch and housing for calibration.
MANUFACTURER AND MODEL:	Det-Tronics Pointwatch Eclipse Model PIRECL or approved equal in accordance with B6

INSTRUMENT SPECIFICATION NUMBER:	**I-106**
DEVICE:	H2S Gas Detector
TAG:	M921-GIT, M931-GIT
SERVICE:	Wet well monitoring
RANGE:	0 to 50 ppm
SENSOR:	Electrochemical
INACCURACY:	±10% of span or ±3 PPM, whichever is greater
OUTPUT:	4 to 20 mA DC into 500 OHM
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	Stainless steel wetted parts
ELECTRONIC ENCLOSURE:	Explosion proof, stainless steel
CERTIFICATIONS:	CSA Class 1, Div 1, Groups C & D
ACCESSORIES:	mounting bracket, hydrophobic filter
MOUNTING:	Mount 600mm from floor on Level 300, 1500mm from floor on Level 200
CALIBRATION:	include calibration kit with 2 gas bottles, carrying case, regulator, calibration tubing and hook-up to weather baffle.
MANUFACTURER AND MODEL:	Det-Tronics Infiniti U9500 transmitter with C706E gas sensor, or approved equal in accordance with B6.

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.3 SAMPLES

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

.2 Provide Contract Administrator with access to source and processed material for sampling.

Part 2 Products

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed five times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

2.2 SOURCE QUALITY CONTROL

.1 If, in opinion of Contract Administrator, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.2 Advise Contract Administrator 4 weeks in advance of proposed change of material source.

.3 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 PREPARATION

.1 Handling

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.2 Stockpiling

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Contract Administrator. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet Project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Contract Administrator within 48 h of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Max 1.5 m for coarse aggregate and base course materials.

.2 Max 1.5 m for fine aggregate and sub-base materials.

.3 Max 1.5 m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Remove any unused aggregates from site.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 05 17 – Aggregate Materials.

1.2 MEASUREMENT PROCEDURES

.1 Shoring, bracing, cofferdams, underpinning and normal de-watering of excavation will not be measured separately for payment.

.2 Backfilling will not be measured separately for payment. Placing and spreading of topsoil will not be measured separately for payment.

.3 The Contractor shall include a cash allowance of $30,000.00 for groundwater depressurization, if required. The cash allowance will cover installation and removal of the pump from the existing test well and a daily unit rate for operation of the depressurization system.

1.3 REFERENCES

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

.1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m ;).

.5 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.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.

.3 Canadian Standards Association (CSA International)

.1 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.

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

1.4 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock : solid material in excess of 1.00 m ; and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 mm in any dimension.

.3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.6 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 **Table:**

Sieve Designation	**% Passing**
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

.3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.7 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 SUBMITTALS

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

.2 Quality Control:

.1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.

.2 Submit for review by Contract Administrator proposed dewatering and heave prevention methods as described in PART 3 of this Section.

.3 Submit to Contract Administrator written notice at least 7 days prior to excavation work, to ensure cross sections are taken.

.4 Submit to Contract Administrator written notice when bottom of excavation is reached.

.5 Submit to Contract Administrator testing results and report as described in PART 3 of this Section.

.3 Preconstruction Submittals:

.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.

.2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field clearance record from utility authority location plan of relocated and abandoned services, as required.

.4 Samples:

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

.2 Inform Contract Administrator at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

.3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

.4 Ship samples prepaid to Contract Administrator in tightly closed containers to prevent contamination and exposure to elements.

1.6 QUALITY ASSURANCE

.1 Submit design and supporting data at least 2 weeks prior to beginning Work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada.

.3 Keep design and supporting data on site.

.4 Engage services of qualified professional Engineer who is registered or licensed in Province of Manitoba, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.5 Do not use soil material until written report of soil test results are reviewed and accepted by Contract Administrator.

.6 Health and Safety Requirements.

1.7 EXISTING CONDITIONS

.1 Examine Geotechnical Investigation Report and Hydrogeological Assessment Reports in appendices A and B.

.2 Buried services:

.1 Before commencing work establish location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify applicable authorities having jurisdiction to establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.6 Confirm locations of buried utilities by careful soil hydrovac methods.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Contract Administrator before removing or re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:

.1 Conduct, with Contract Administrator, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Contract Administrator.

Part 2 Products

2.1 MATERIALS

.1 Type 1 and Type 2 fill: properties to Section 31 05 17 - Aggregate Materials and the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1

.3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30

Sieve Designation	% Passing	
	Type 1	Type 2
0.180 mm	-	-
0.075 mm	3-8	0-10

.2 Type 3 fill: selected material from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Shearmat: honeycomb type bio-degradable cardboard 150 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures 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 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.3 PREPARATION/PROTECTION

.1 Protect existing features.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Contract Administrator approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.

.5 Protect concrete duct bank from any settlement or movement.

3.4 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as directed by
Contract Administrator after area has been cleared of brush weeds and grasses and removed from site.

.2 Strip topsoil to depths as directed by Contract Administrator.

.1 Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed by Contract Administrator.

.1 Stockpile height not to exceed 2 m and should be protected from erosion.

.4 Dispose of unused topsoil off site.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by Contract Administrator.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Health and Safety Act for the Province of Manitoba.

.2 Obtain permit from authority having jurisdiction for temporary diversion of water course.

.3 Construct temporary Works to depths, heights and locations as indicated.

.4 During backfill operation:

.1 Unless otherwise indicated or directed by Contract Administrator, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.

.5 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.6 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore watercourses.

3.7 DEWATERING AND GROUNDWATER DEPRESSURIZATION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Contract Administrator's review details of proposed dewatering or groundwater depressurization methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater depressurization, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water to approved runoff areas and in manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.8 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated by Contract Administrator.

.2 Remove concrete masonry paving walks demolished foundations and rubble and other obstructions encountered during excavation.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 Restrict vehicle operations directly adjacent to open excavations.

.6 Dispose of surplus and unsuitable excavated material off site.

.7 Do not obstruct flow of surface drainage or natural watercourses.

.8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.9 Notify Contract Administrator when bottom of excavation is reached.

.10 Obtain Contract Administrator’s acceptance of completed excavation.

.11 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings.

.2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected Standard Proctor maximum dry density.

.12 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.9 EXCAVATION OF CONTAMINATED SOILS

.1 Dispose of contaminated soil in accordance with Section 02066 – Contaminated Soils.

.2 Commence backfilling of excavated soil areas within 3 days of receipt of confirmatory sampling results indicating no further excavation in the area is required. Costs for any extra work caused as a result of leaving excavations open longer will be the responsibility of the Contractor.

3.10 FILL TYPES AND COMPACTION

.1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.

.1 Exterior side of perimeter walls: use Type 1 fill to subgrade level. Compact to 95% of corrected maximum dry density.

.2 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill topped with shearmat filler as indicated to underside of slab. Compact base course to 100%.

3.11 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

.1 Contract Administrator has inspected and accepted construction below finish grade.

.2 Inspection, testing, approval, and recording location of underground utilities.

.3 Removal of concrete formwork.

.4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.150 m.

.6 Install drainage filter system in backfill as indicated.

3.12 RESTORATION

.1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Contract Administrator.

.2 Replace topsoil as directed by Contract Administrator.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Clean and reinstate areas affected by Work as directed by Contract Administrator.

.5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-04(July 2005), Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-G30.18-M92(2002), Billet Steel Bars for Concrete Reinforcement.

.3 CSA W48-01(R2006), Filler Metals and Allied Materials for Metal Arc Welding.

1.2 SUBMITTALS

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

.2 Shop Drawings:

.1 Indicate: reinforcing.

.2 Submit each drawing complete with signature and stamp of qualified professional engineer registered or licensed in Provinces of Manitoba, Canada.

.3 Quality assurance submittals:

.1 Records and reports: submit concrete tests as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Submit for review by Contract Administrator three copies of pile installation records as described in PART 3 - FIELD QUALITY CONTROL.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing weldable, 400.

.3 Welding materials: to CSA W48 AWS D1.4/D1.4M.

.4 Grout: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.2 SOURCE QUALITY CONTROL

.1 Concrete tests: to CSA-A23.1/A23.2.

Part 3 Execution

3.1 INSTALLATION

.1 Bore holes to diameters and depths as indicated.

.2 Protective steel casing:

.1 Where required, use steel protective casing approved by Contract Administrator.

.1 Ensure penetration of casing to required depths either by self mass or driving.

.3 Dispose of excavated materials off site.

.4 Contract Administrator to inspect pile excavation prior to placing of concrete.

.1 Remove loose material, foreign matter and water.

.5 Install steel reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing and as indicated.

.6 Fill pile excavations with concrete to elevations as indicated.

.1 Place concrete in one continuous pour in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.7 Steel protective casing shall be removed.

.8 Where steel protective casing is to be removed, provide concrete with minimum slump of 125 mm and with retarder to prevent arching or setting of concrete.

.1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing 600 mm below level of concrete.

.2 Do not vibrate concrete internally.

.9 Use tremie pipe or concrete pumping with approval of Contract Administrator.

3.2 DEFECTIVE PILES

.1 Cased concrete shaft piles rejected where:

.1 Soil has entered casing.

.2 Casing is damaged, out of tolerance or alignment.

3.3 FIELD QUALITY CONTROL

.1 Field Records: maintain drilling record for each pile, including elevation of tip, length of pile, elevation of top of pile.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for foundation and underslab drainage.

1.2 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 31 23 10 - Excavating, Trenching and Backfilling.

.3 Section 31 05 17 - Aggregate Materials.

1.3 REFERENCES

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

.1 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-00(June 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CSA B1800-02, Plastic Non-pressure Pipe Compendium - B1800 Series B182.7, B182.8 and B182.11).

.1 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).

1.4 SITE CONDITIONS

.1 Examine sub-surface investigation report which is available for inspection at UMA Engineering Ltd., 1479 Buffalo Place, Winnipeg, MB.

.2 Known underground utility lines and buried objects are as indicated on plans.

Part 2 Products

2.1 BEDDING AND SURROUND MATERIALS

.1 Coarse filter aggregate: to CSA-A23.1/A23.2, Group 1 20-5 mm in accordance with Section 31 05 17 - Aggregate Materials.

.2 Fine filter aggregate: to CSA-A23.1/A23.2 in accordance with Section 31 05 17 - Aggregate Materials.

.3 Rigid plastic pipe and fittings: to CSA-B182.1, size NPS 4, complete with fittings.

.4 Geotextile filter: see Section 31 32 21 - Geotextiles.

.5 Cleanouts: .

2.2 BACKFILL MATERIAL

.1 Type 2, in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use if approved by Contract Administrator.

Part 3 Execution

3.1 EXAMINATION

.1 Ensure graded base conforms with required drainage pattern before placing bedding material.

.2 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Contract Administrator.

.3 Ensure foundation wall and dampproofing have been installed and accepted by Contract Administrator before placing bedding material.

3.2 BEDDING PREPARATION

.1 Cut trenches in base and place bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth of 300 mm.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.3 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.3 PIPE OR TUBING INSTALLATION

.1 Ensure pipe interior and coupling surfaces are clean before laying.

.2 Lay perforated pipe minimum to slope of 1:100. For pipe face perforations and coupling slots downward.

.3 Lay non-perforated pipe to slope of 1:50 from perforated pipe to disposal area. Make joints watertight.

.4 Grade bedding to establish pipe slope.

.5 Install end plugs at ends of collector drains to protect pipe ends from damage and ingress of foreign material.

.6 Connect non-perforated pipe to sump pit by appropriate adapters manufactured for this purpose.

.7 Provide cleanouts on non-perforated pipe at changes of pipe direction and in runs greater than 15 m.

3.4 PIPE OR TUBING SURROUND MATERIAL

.1 Upon completion of pipe laying and after Contract Administrator has inspected Work in place, surround and cover pipe and install geotextile filter as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness, as indicated. Do not drop material within 1 m of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Compact each layer from pipe tubing invert to mid-height of pipe to at least 95% maximum density to ASTM D698.

.5 Compact each layer from mid-height of pipe to underside of backfill to at least 90% maximum density to ASTM D698.

3.5 BACKFILL MATERIAL

.1 Place backfill material above pipe tubing surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

END OF SECTION

Appendix A
Geotechnical Investigation Report

UMA Engineering Ltd.
1479 Buffalo Place
Winnipeg, Manitoba R3T 1L7
T 204.284.0580 F 204.475.3646 www.uma.aecom.com

Memorandum

Date: September 14, 2007
To: Blair Moore, UMA
From: Faris Khalil, UMA
Subject: Perimeter Road Sewage Pumping Station (PRPS) Reliability Upgrade
Geotechnical Investigation Report
Project Number: D265-202-02 (4.6.1)

Distribution: Barry Biswanger

INTRODUCTION

This memorandum summarizes the results of the geotecnhical investigation and provides foundation and excavation recommnedations for the proposed PRPS upgrade.

GEOTECHNICAL INVESTIGATION

On April 16 and 18, 2007, three test holes (07-01 to 07-03) were drilled to assess the soil and groundwater conditions at the proposed pumping station stair well locations as shown on Test Hole Location Plan, Figure 01. Drilling of test holes was completed by Paddock Drilling Ltd. using a truck mounted Acker MP5-T and SS2 drill rig equipped with 125 mm diameter solid stem augers. Test Hole (TH) 07-01 was drilled near the south side of the existing building and TH 07-02 and 07-03 were drilled near the northeast and northwest corners of the exisitng building, respectively. TH 07-01 was advanced into the till to a depth of 15.2 m below the existing ground surface. Test Holes 07-02 and 07-03 were advanced into the till to the depth of auger refusal at 22.1 and 18.4 m below the existing ground surface, respectively.

The soils observed during drilling of the test holes were visually classified on site by Mr. Stephen Peters, E.I.T. of UMA Engineering. Disturbed soil samples of auger cuttings were collected at regular intervals in each test hole. Standpipe piezometers fitted with Casagrande tips were installed in each test hole to facilitate measurement of groundwater levels in the till. Piezometer construction details are shown on the test hole logs in Appendix A.

Laboratory testing was conducted at UMA's Material Laboratory in Winnipeg and consisted of moisture content determination, plasticity tests (Atterberg limits), undrained shear strength, and grain size analysis.

A detailed test hole log has been prepared for each test hole to record the description and the relative position of the various soil strata, location of samples obtained, field and laboratory test results, and other pertinent information. Groundwater levels observed after drilling are also recorded on the test hole logs. The test hole logs and laboratory results are provided in Appendix A.

Appendix A
Geotechnical Investigation Report

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1479 Buffalo Place
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The soils observed during drilling of the test holes were visually classified on site by Mr. Stephen Peters, E.I.T. of UMA Engineering. Disturbed soil samples of auger cuttings were collected at regular intervals in each test hole. Standpipe piezometers fitted with Casagrande tips were installed in each test hole to facilitate measurement of groundwater levels in the till. Piezometer construction details are shown on the test hole logs in Appendix A.

Laboratory testing was conducted at UMA's Material Laboratory in Winnipeg and consisted of moisture content determination, plasticity tests (Atterberg limits), undrained shear strength, and grain size analysis.

A detailed test hole log has been prepared for each test hole to record the description and the relative position of the various soil strata, location of samples obtained, field and laboratory test results, and other pertinent information. Groundwater levels observed after drilling are also recorded on the test hole logs. The test hole logs and laboratory results are provided in Appendix A.

SUBSURFACE CONDITIONS

The general soil profile in descending order is:

- Topsoil
- Sand Fill
- Clay Fill
- Clay
- Till

These soil units are described separately as follows:

Topsoil

Topsoil 0.2 m thick was encountered at the ground surface at TH 07-01. The topsoil consists of black silty clay and contains trace organics.

Sand Fill

Sand fill about 0.6 m thick was encountered at the ground surface at TH 07-02 and 07-03. The sand is brown and moist and contains some gravel and trace silt.

Clay Fill

Medium to highly plastic grey and brown silty clay was encountered below the topsoil and sand fill. The material is believed to be the backfill material used in the original construction in 1963/1964. The clay fill is generally firm to stiff, moist and contains trace organics, trace silt seams and trace gypsum inclusions (sulphates). The moisture content of the clay ranges between 39 and 22 percent and decreases with depth. At the time of the drilling the clay was frozen to a depth of about 1.8 m below existing ground surface. Undrained shear strengths as determined by unconfined compression test increase with depth in a range from 30 to 70 Kpa. The results of unconfined compression test were reasonably consistent with torvane and pocket pentrometer results. Field moisture contents are close to the plastic limit indicating the stiff nature of the material.

Clay

Low to medium plastic silty clay was encountered in TH07-02 underlying the clay fill at about 12 to 13m below the existing ground surface. The clay is grey, stiff to very stiff with average moisture contents of 13 percent.

Till

Till was encountered below the fill and clay in all the test holes at depths from 7.0 to 19.5m. In TH 07-01 the till consists of an upper unit of silt till about 3 m thick and lower clay till unit which extends to the bottom of the test holes. Clay till was encountered at the other two test holes. The silt till is brown, moist to dry and low to non plastic. The clay till is red, moist to dry and medium plastic. The till contains some sand (10 to 20%), trace gravel

and trace gypsum. Moisture contents range from 10 to 25 percent. Sloughing was observed from the till in TH07-01 at a depth of 14.6m below the existing ground surface.

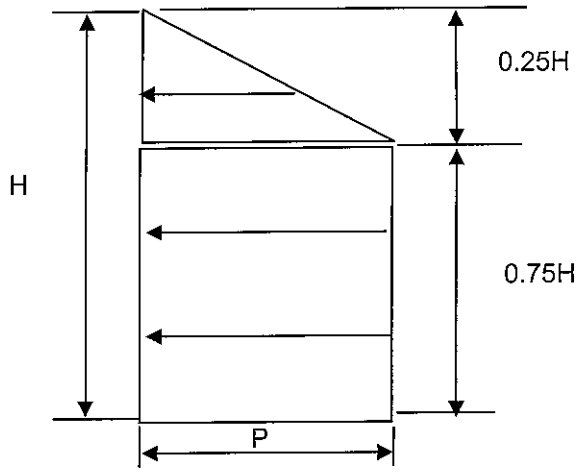
Groundwater

Seepage was not noted in the test holes during drilling. Standpipe piezometers fitted with Casagrande tips were installed in each test hole at completion of drilling to facilitate measurement of groundwater levels in till. The groundwater level was measured at 5.3 to 5.8 m below the ground surface on May 3, 2007. The measured groundwater levels were lower than would be regionally expected and most likely were affected by groundwater dewatering (pumping) for the construction at the West End Water Pollution Control Centre.

EXCAVATIONS

It is understood from the available reports that an open excavation with cut slopes of 1H: 1 V to a depth of up to 12m below the ground surface was used for construction of the existing building in the early 1960's. The excavation was backfilled using the excavated material once the underground structure had been completed. The location of the proposed stair wells is most likely within the limits of the original excavation and backfill. Considering the required excavation depth, and the fact that the excavation will be within previously backfilled material and the vicinity of the excavation from the existing building, a shored or partially shored excavation is considered to be the preferred excavation support method. A full depth unsupported open excavation is considered unsuitable and no further discussion is provided in this regard.

Cantilevered shoring in Winnipeg clays is limited to depths of about 4m. Beyond this depth, the shoring will have to be braced or tied back. In this regard, the earth pressure distribution shown in Figure 02 should be used for the design of shoring. Shoring is usually designed to keep movements around the perimeter of the excavation within acceptable limits. Avoidance of ground movements entirely is not possible. The amount of movement that will occur cannot be accurately predicted mainly because the movements are more a function of excavation procedures and workmanship than they are of theoretical considerations. Settlements of the ground surface adjacent to braced excavation are often estimated using the design chart developed by Peck (1969) as shown in Figure 03. It is recommended that the boundary between Zone I and II be used to estimate vertical ground movements at the site. It should be recognized that the predicted ground movements are associated with standard soldier piles and lagging or sheet piles with cross bracing or tie back anchors, assuming they are installed with a normal quality of workmanship.



P= γH – 4 m S_u *not less than* 0.3 γH,
where
γ = 18 kPa , m= 1.0, S_u= 40 kPa
H= depth of excavation in meter

Figure 02: Earth Pressure Distribution for Shored Excavations

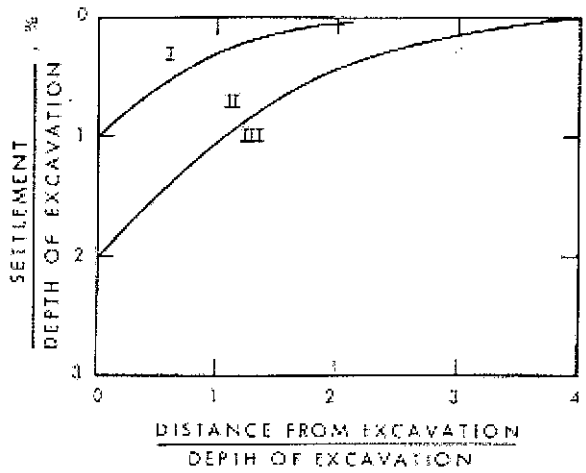


Figure 03: Ground Settlement estimate adjacent to excavation

If used, unsupported excavation shall be limited to the top 3m of the clay backfill and can be cut with back slopes not steeper than (1.5 H: 1 V). If soft zones or perched groundwater are encountered, flatter slopes may be required. The toe of the cut slope should be at least half the depth of the shored excavation from the shoring face.

A perimeter ditch should be provided to intercept surface runoff and/or any groundwater from entering the excavation.

The shallow clay/till contact encountered in TH 07-01 and the presence of stiff to very stiff clay in TH07-02 and 07-03 may impose installation difficulties for a sheet pile shoring system. Driving of soldier piles into the stiff clay and till units to the required embedment depth may generate ground vibration level intolerable to the existing building. Another possibility associated with the soldier pile driving is the potential for premature refusal before the required embedment depth is reached. Sacrificial soldier piles can be installed in pre-drilled holes to the required embedment depth and backfilled with normal strength concrete below the excavation line. Good contact between the lagging and retained soil should be maintained throughout the construction period. Free draining sand should be used to fill the voids behind the lagging. The soldier piles may be integrated structurally with the permanent stair well walls.

The potential of base instability and associated ground displacement adjacent to the excavation must be recognized in the design of deep excavations. The factor of safety against base instability should be determined using the equation:

$$F_{sb} = (N_b S_u) / \sigma_z$$

Where:

F_{sb} = Factor of Safety with respect to base instability
N_b = stability factor depending on the geometry of the excavation
S_u = Undrained shear strength of the clay below base level
σ_z = Total overburden pressure at base level

A minimum factor of safety of 1.50 is recommended for design purposes. For the proposed maximum excavation depth the factor of safety against base instability exceeds the design objective of 1.50, provided no surcharge is allowed within a distance equal to half the depth of the excavation from the shoring face. The factor of safety calculation was made based on undrained shear strength of 40 to 50 kpa and unit weight of 18 kN/m^3 for the clay. All excavations should be completed in accordance with Manitoba Workplace Health and Safety Regulations.

BASE HEAVE

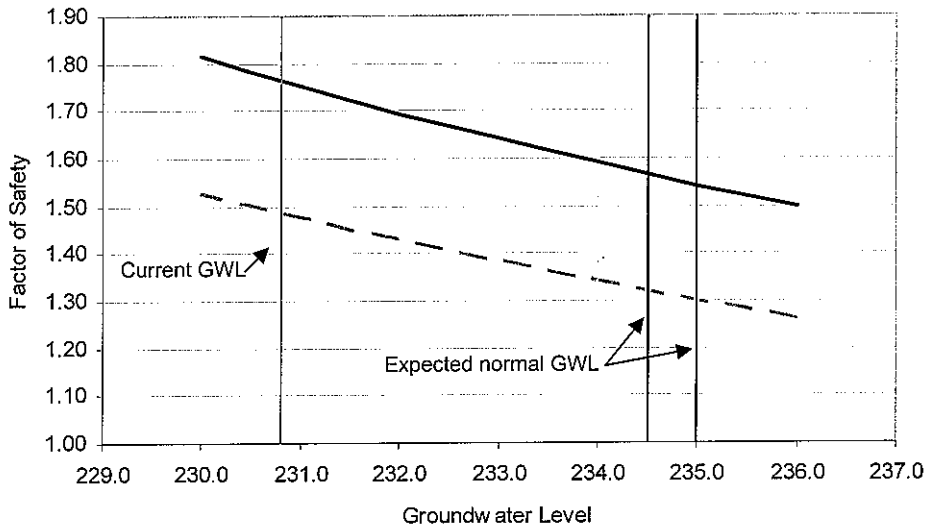
Where impervious layer(s) are underlain by a pervious layer under artesian pressure, the potential for base heave must be taken into consideration for both short and long term. Heaving of the impervious layer(s) and any infrastructure located within it can occur if the groundwater pressure at the contact is sufficient to overcome its weight.

The factor of safety (FS) against base heave is expressed as the ratio of the total stress (weight of soil) at the base of the impervious layer(s) to the groundwater pressure acting on the base. In this regard, a minimum factor of safety of 1.5 and 1.30 are recommended for long and short term design objectives. Long term conditions pertain to base heave potential for the completed structure and short term condition pertains to conditions during construction.

A site specific hydrogeological investigation was undertaken by UMA to assist in the assessment for the potential of seepage and base heave. The results of the investigation is presented in UMA report " Perimeter Road Pumping Station - 6281 Wilkies Avenue,Winnipeg,MB- Hydrogeological Assessment Report" date September 14, 2007. Based on the hydrogeological assessment report, the impervious layers (clay, silt and clay till and the Amaranth Formation of shales /siltstones) extend to a depth of 36.6m below the existing ground surface. Limestone bedrock with fractured and water bearing zones under artesian pressure underlies these layers. The hydrogeological assessment report indicated that while the current measured groundwater in bedrock aquifer is at about elevation 230.0 the regional groundwater level is likely to stabilize at elevation 234.5 to 235.0, once pumping operation at the West End Water Pollution Control Centre is terminated. The factor of safety against base heave corresponding to groundwater level in the bedrock aquifer for each design case was estimated using an average soil unit weight of 18 kN/m^3, the results are shown on Figure 04. For the current and expected normal groundwater levels the factor of safety exceeds or meets the design objective as shown in Figure 04.

Groundwater depressurization of the limestone aquifer will likely not be required, however groundwater monitoring is recommended before and during construction to confirm that groundwater levels do not exceed the assumed values in determination of the factor of safety against base heave.

Figure 04 : Factor of Safety Against Base heave



During construction, the potential for groundwater flow along existing vertical fractures in the clay cannot be ruled out even if the base of the excavation does not heave. Should such fractures exist, groundwater flow could occur into the excavation. In this circumstance, groundwater flow may start slowly and gradually increase over time due to erosion along the fractures. Should it occurs, it is expected that the seepage be at a rate which can be handled by conventional construction dewatering equipment.

FOUNDATIONS

North Side Stairwell

A floating foundation can be used to support the north side stairwell. Foundations placed at depths where the structural weight equals the weight of displaced soil usually assures adequate bearing capacity and only recompression settlement. Where the structural loads are less than the weight of the excavated soil the foundation is considered to be overcompensated. The depth of the proposed stairwells at the north end of the building is about 13 m below the existing ground and the unloading due to excavation is estimated to be 234 kPa. The pressure from the structure (dead load only) on the foundation soil is estimated to be 79 kpa, thus the foundation is overcompensated. At the foundation level there will be a maximum unloading of 155 kPa.

Soil displacement and upward rebound at the foundation level is expected as a result for stress relief due to excavation unloading. The rebound movement is excpected to be partially restrained by the weight of the structure, integrity of the stair well with the existing building and side friction along the stair well walls and backfill. Theoretically the rebound will continue up to a point where the stress at the foundation level is equal to the in-situ overburden pressure before the excavation. In this regard, the base of the stair well should be designed to resist a uniform upward pressure of 130 kpa. The influence of the material surrounding the excavation on the distribution of stresses and displacementes within the medium below the excavation made the prediction of soil rebound a complex soil-structure interaction case. However, it is expected that upward movement in the order of 25 mm may occur during mobilization of sufficient resistance to restrain further soil rebound. The following recommendations should be incorporated in the design and construction of the foundation:

1. Footing should not be placed on loose, disturbed or fill soil.

2. The foundation should be suitably designed to act as a rigid foundation.

3. Care should be taken during excavation to ensure that the bearing surface is not disturbed or subjected to freezing, water inundation or excessive drying. All loosened or disturbed soils should be removed from the final bearing surface.

4. Care should be taken during excavation to limit the loss of ground from underneath the footings of the existing adjacent building.

5. Once the bearing surface has been suitably prepared, it should be evaluated by qualified geotechnical personnel to verify the suitability of the proposed bearing soils, confirm that the soils are uniform, not affected by frost or disturbance and to confirm that the soils encountered are consistent with the conditions noted in this report.

6. As soon as possible, following approval of the bearing surface by qualified geotechnical personnel, the steel reinforcing should be placed and concrete shall be poured.

South Side Stairwell

The depth of the proposed stair well on the south side is about 3.8m below the ground surface. The logs of TH 07-01 shows that clay fill extends up to 7.0m below the exisitng ground surface. The fill is not considered to be competent bearing strata and the stair well structre should not be founded on this unit. The use of driven piles to support the structure may adversly impact the exisitng building and utilities and it is not recommended without proper vibration monitoring. Cast-in-place concrete friction piles can be used to support the structure. An allowable unit skin friction resistance of 15 kpa can be used to estimate the pile's load carrying capacity. No skin friction resistance shall be accounted for the length of the pile within the fill (i.e., about 3.2 m below the underside of the stair well or 7.0 m below the ground surface). Further design and construction recommendations for cast-in-place concrete frictions piles are summarized below:

1. The contribution from end-bearing should be ignored.
2. The piles should be spaced a minimum of three pile diameters, measured center to center.
3. The weight of the embedded portion of the pile may be neglected in the design.
4. All piles should be provided with adequate steel reinforcement.
5. Concrete should be placed as soon as practical following the drilling of each pile.
6. Seepage and sloughing can be expected in pile holes, particularly during wetter times of the year. As such, steel sleeves should be made available on site and utilized as required during construction to maintain the pile holes in a clean dry state.
7. Void space shall be provided under the base slab of the stairwell to avoid pressure from soil rebound.

EARTH PRESSURE

Permanent stair well walls should be designed to resist at-rest lateral earth pressure derived on the basis of the following conventional relationship which produces triangular pressure distribution:

$$P=K_o\gamma D$$

Where:

P= Lateral earth pressure at depth D (kPa)
K_o= At-rest earth pressure coefficient = 0.70
γ = Soil/Backfill unit weight =18 (kPa)
D = depth from ground surface to point of pressure calculation (m)

Below the groundwater table, the hydrostatic water pressure must be added and the submerged or buoyant weight of soil/backfill can be used. In this regard, long term groundwater table can be assumed at 2.0 m below the existing ground surface.

Where required, backfill between the stair well walls and the excavated faces should consist of granular material. The backfill should be sufficiently compacted only to minimize settlement of the backfill itself. A clay cap of 1 m minimum thickness should be used at the ground surface to protect against ingress of surface water to the footing level.

Foundation Concrete

The degree of exposure of concrete in contact with soils to sulphate attack is classified in CSA-A23.1-M2004 (Concrete Materials and Methods of Concrete Construction) as moderate, severe or very severe. Based on significant data gathered through previous work in the Winnipeg area and in accordance with the Manitoba Building Code, the degree of exposure for soils in Winnipeg is commonly classified as severe. Accordingly, all concrete in contact with the soils should be made with sulphate resistant cement (CSA Type 50) in accordance with CSA-A23.1-M2004.

CONSTRUCTION TESTING AND MONITORING

The engineering design recommendations presented within this memorandum are based on the assumption that an adequate level of geotechnical monitoring will be provided during construction and that qualified contractors experienced in foundations and excavations will carry out the construction. An adequate level of geotechnical monitoring is considered to be regular monitoring of footing construction procedures and compaction testing for earthworks related to shallow foundations and excavations.

If the conditions encountered during construction are different from the conditions reported in this report or the conditions upon which the recommendations in this report are made, our office shall be contacted so that our recommendations can be reviewed and modified if required.

Respectfully submitted,

UMA Engineering Ltd.

Faris Khalil, M.Sc., P.Eng.
Senior Geotechnical Engineer
Earth and Water

Reviewed by

Ken Skaftfeld, P.Eng.
Senior Geotechnical Engineer
Earth and Water

Appendix A
Test Holes Log

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-1**
LOCATION: South Side of Wilkes Pumping Station N 5,522,058.9 E 620,794.5		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker SS2, 125 mm dia. SSA	ELEVATION (m): 238.353

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PLASTIC / M.C. / LIQUID (20 40 60 80)	COMMENTS	ELEVATION (m)
0	TOPSOIL - trace organics (rootlets), black					238
	CLAY (Fill) - silty - light brown - stiff, moist - medium to high plasticity		G129			
1						237
	- trace sand, trace gravel, firm below 1.5 m					
2			G130			236
3	- brown, firm to stiff, trace silt pockets below 3.0 m					235
4			G131			234
5						233
6			G132			232
	- trace till inclusions					
7	SILT (Till) - some clay, some sand, trace gravel - brown - moist - low to non plastic		G133			231
8	- dry below 8.2 m					230
			G134			
9						229
10	CLAY (Till) - silty, some sand, trace gravel - red - dry to moist - trace of gypsum, white fine grained - medium plasticity		G135			228
11						227
12			G136			226
13	- light brown/red, dry below 12.8 m					

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 15.24 m
REVIEWED BY:	COMPLETION DATE: 18/4/07
PROJECT ENGINEER: Faris Khalil	Page 1 of 2

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-1**
LOCATION: South Side of Wilkes Pumping Station N 5,522,058.9 E 620,794.5		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker SS2, 125 mm dia. SSA	ELEVATION (m): 238.353

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PLASTIC / M.C. / LIQUID (20 40 60 80)	COMMENTS	ELEVATION (m)
13								225
14			- dry to moist below 13.7 m		G137			224
15					G138			223
16			END OF TEST HOLE AT 15.2 m Notes: 1. Slougthing at 14.6m. 2. No seepage observed. 3. Installed standpipe at 15.2 m, with flush mount cover. 4. Backfilled test hole with sand to 13.1 m, bentonite chips to 10.1 m and auger cuttings to surface. 5. Water level at 5.80 m below ground surface on May 1, 2007.					222
17								221
18								220
19								219
20								218
21								217
22								216
23								215
24								214
25								213
26								

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 15.24 m
REVIEWED BY:	COMPLETION DATE: 18/4/07
PROJECT ENGINEER: Faris Khalil	Page 2 of 2

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-2**
LOCATION: North East corner of Wilkes Pumping Station N 5,522,087.2 E 620,804.7		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.305

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	△ Pocket Pen. (Su) △ (kPa) 50 100 150 200 / ■ Total Unit Wt ■ (kN/m³) 17 19 21 23 / PLASTIC M.C. LIQUID 20 40 60 80	× QU (Su) × (kPa) 50 100 150 200 / + Torvane (Su) + (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
0	SAND (Fill) - some gravel, trace silt - brown, moist					238
1	CLAY (Fill) - silty, trace gravel - black - frozen to ~1.8 m - low to medium plasticity - organic odour	G113				237
2	- firm to stiff, moist, below 1.8 m					236
3	- some silt inclusions, trace organics, grey, medium to high plasticity, organic odour below 2.4 m	G114 T115				235
4		G116				234
5	- firm below 4.6 m					233
6		G117				232
7	- trace sand, dry to moist, silt seams (~1mm thick) - trace organics, grey to black, some red, firm to stiff, medium to high plasticity - organic odour	T118 G119				231
8	- red below 7.9 m - trace gypsum, white fine grained					230
9		G120 T121				229
10		G122				228
11	- stiff to very stiff below 11.0 m - dry to moist					227
12	CLAY - silty, trace sand, trace fine gravel - brown - stiff to very stiff, dry - low to medium plasticity	G123				226
13						

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 22.10 m
REVIEWED BY:	COMPLETION DATE: 16/4/07
PROJECT ENGINEER: Faris Khalil	Page 1 of 2

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-2**
LOCATION: North East corner of Wilkes Pumping Station N 5,522,087.2 E 620,804.7		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.305

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	△ Pocket Pen. (Su) △ (kPa) 50 100 150 200 / ■ Total Unit Wt ■ (kN/m³) 17 19 21 23 / PLASTIC M.C. LIQUID 20 40 60 80	× QU (Su)× (kPa) 50 100 150 200 / + Torvane (Su) + (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
13									225
14			- grey below 14.0 m		G124				224
15					G125				223
16									222
17					G126				221
18									220
19									219
20			CLAY (Till) - silty, some sand, trace gravel, trace organics - brown - moist - medium plasticity		G127				218
21									217
22					G128				216
23			END OF TEST HOLE AT 22.1 m Notes. 1. Power auger refusal at 22.1 m. 2. No sloughing observed. 3. No seepage observed. 4. Installed standpipe at 22.1 m, with flush mount cover. 5. Backfilled test hole with sand to 20.6 m, bentonite chips to 17.5 m and auger cuttings to surface 6. Water level at 5.38 m below ground surface on May 1, 2007.					215
24									214
25									213
26									

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 22.10 m
REVIEWED BY:	COMPLETION DATE: 16/4/07
PROJECT ENGINEER: Faris Khalil	Page 2 of 2

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-3**
LOCATION: North West corner of Wilkes Pumping Station N 5,522,085.4 E 620,783.2		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.304

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	ELEVATION (m)
0	SAND (Fill) - some gravel, trace silt - brown, moist			238
1	CLAY (Fill) - silty, trace gravel, trace rootlets - black to dark brown - frozen to ~1.5 m - organic odour	G	G100	237
2	- some silt inclusions, grey, firm to stiff, moist, medium to high plasticity below 1.5 m - trace gypsum, white fine grained near 1.5 m	G	G101	236
3		T	T102	235
4		G	G103	234
5	- trace rootlets, silt seems, stiff, organic odour below 4.6 m	T	T104	233
6		G	G105	232
7		G	G106	231
8	- some red below 7.9 m			230
9	- trace gypsum, white fine grained at 8.8 m - trace organics - organic odour	G	G107	229
10		G	G108	228
11	- trace organics, silt seems, black at 10.4m - red below 10.7 m			227
12		G	G109	226
13				

SLOTTED PIEZOMETER | SOIL SYMBOL

△ Pocket Pen. (Su) △ (kPa) 50 100 150 200

■ Total Unit Wt ■ (kN/m^3) 17 19 21 23

PLASTIC M.C. LIQUID 20 40 60 80

× QU (Su) × (kPa) 50 100 150 200

+ Torvane (Su) + (kPa) 50 100 150 200

COMMENTS

UMA | AECOM	LOGGED BY: S. Peters	COMPLETION DEPTH: 18.39 m
	REVIEWED BY:	COMPLETION DATE: 16/4/07
	PROJECT ENGINEER: Faris Khalil	Page 1 of 2

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-3**
LOCATION: North West corner of Wilkes Pumping Station N 5,522,085.4 E 620,783.2		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.304

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	ELEVATION (m)
13	CLAY (Till) - silty, sandy, trace gravel - light grey - dense, dry to moist - trace gypsum, white fine grained				225
14					224
15			G110		223
16	- red, moist, compact to dense below 15.5 m				222
17			G111		221
18			G112		220
19	END OF TEST HOLE AT 18.4 m. Notes. 1. Power auger refusal at 18.4 m. 2. Squeezing near 12.2 m 3. Installed standpipe at 18.4 m, with flush mount cover. 4. Backfilled test hole with bentonite chips to 9.1 m and auger cuttings to surface. 5. Water level at 5.31 m below ground surface on May 1, 2007.				219
20					218
21					217
22					216
23					215
24					214
25					213
26					

△ Pocket Pen. (Su) △ (kPa) 50 100 150 200

■ Total Unit Wt ■ (kN/m³) 17 19 21 23

PLASTIC M.C. LIQUID 20 40 60 80

× QU (Su) × (kPa) 50 100 150 200

+ Torvane (Su) + (kPa) 50 100 150 200

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 18.39 m
REVIEWED BY:	COMPLETION DATE: 16/4/07
PROJECT ENGINEER: Faris Khalil	Page 2 of 2

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

PLAN

0 5 10 m SCALE 1:500

City of Winnipeg
Perimeter Road Sewage Pumping Station Reliability
PRPS Upgrades

Test Holes Location Plan

UMA | AECOM

Figure - 01

Appendix B
Hydrogeologic Assessment Report

B. Moore.

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UMA Engineering Ltd.
1479 Buffalo Place
Winnipeg, Manitoba R3T 1L7
T 204.284.0580 F 204.475.3646 www.uma.aecom.com

September 14, 2007 File: D265-202-00 (4.6.1)

The City of Winnipeg
Water and Waste Department
109 – 1199 Pacific Avenue
Winnipeg, Manitoba
R3E 3S8

Attention: Mr. Chris Carroll, P. Eng.
Project Engineer

Dear Mr. Carroll:

RE: Perimeter Road Pumping Station
6821 Wilkes Avenue, Winnipeg, MB
Hydrogeologic Assessment Report

UMA Engineering Ltd. (UMA) is pleased to provide you with the following assessment of the potential to encounter adverse groundwater conditions during the construction of the proposed upgrades to the Perimeter Road Pumping Station (PRPS) at 6821 Wilkes Avenue (Drawing No. 01). Based on current design information, it is understood that excavations to a depth of 14 metres below grade are required at this site as part of the upgrades. Long term monitoring of groundwater levels at a provincial groundwater monitoring station located on Wilkes Avenue west of the Perimeter (Appendix A, Station G05MJ005) indicates that the piezometric pressure within the underlying bedrock aquifer is approximately 2.0 to 2.5 metres below grade. Due to the depth of the excavation, the preliminary assessment of the geologic and hydrogeologic conditions indicated that there was potential for seepage due to heaving of the base of the excavation, or movement of water along pre-existing pathways (fractures, permeable strata) into the excavation. The seepage typically occurs gradually over time but in some cases the failure of the soils can be sudden and can result in the influx of large volumes of groundwater. To address this concern, investigations were undertaken as outlined in this report.

1.0 BACKGROUND INFORMATION REVIEW

As part of the assessment of the potential to encounter adverse groundwater conditions during the construction of the proposed upgrades to the Perimeter Road Pumping Station, the available information on the geology and hydrogeology was reviewed. The information reviewed included:

- The Driller's Report for the existing on-site water well as documented in the GWDrill database maintained by the province (Appendix B);
- The updated hydrograph for Provincial Observation Well G05MJ005 located on the north side of Wilkes Avenue and approximately 300 metres west of the Perimeter Highway (Appendix A – Hydrograph, Appendix B – Drillers Report for well G05MJ005);
- The published information on the geology and hydrogeology of the area (Baracos, Shields and Kjartanson, 1983); and,
- Updated surficial geology (Matille, 2004) and bedrock geology (Bezys et al, 2002) maps.

The review of the Driller's Report for the on-site water well (dated May 14, 1964) indicates that the well was drilled subsequent to the construction of the PRPS and was drilled through the floor of the existing structure at a depth of 9.1 m. The stratigraphy underlying the floor was documented to consist of (in descending order): clay till to a depth of 12.5 m; followed by weathered/fractured limestone to a depth of 22.0 m; clay/shale to a depth of 30.2 m; and, limestone to the maximum depth of drilling of 39.0 m. Based on this Driller's Report, the proposed 14 m deep excavations would extend into the upper portion of the weathered/fractured limestone, and therefore into a potential aquifer.

The bedrock geology maps published by Bezys et al (2002) provide the most recent interpretation of the bedrock geology beneath the City of Winnipeg. The maps indicate that the site is underlain by an east-west trending channel eroded into the Ordivician Stony Mountain Formation and infilled by the Jurassic Amaranth Formation. The Amaranth Formation consists of argillaceous dolomitic siltstones and sandstones with occasional gypsum and anhydrite interbeds. In the immediate area of the site, the Stony Mountain Formation consists of interbedded mudstones, limestones and dolomites of the Gunn and Penitentiary Members. The depth to bedrock varies from 7.5 m below grade to the north of the PRPS site to 17.5 m below grade to the south.

The regional bedrock geology information published by Bezys et al (2002) indicates that the site is underlain by siltstones and sandstones rather than the weathered and fractured limestones reported in the 1964 Driller's Report. In order to resolve this apparent discrepancy, an exploration test hole was drilled as part of this program and a test well installed. The purpose of this work was to confirm if the site is underlain by siltstones and sandstones rather than the limestones indicated on the historic Driller's Report. An additional purpose of this work was to obtain preliminary information on the permeability of the siltstones, sandstones and limestones.

2.0 FIELD INVESTIGATIONS

2.1 Geotechnical Test Hole Drilling

As part of the geotechnical assessment for this site, three test holes (TH07-1 to 3) were drilled at the locations shown on Drawing No. 01 to confirm the overburden soil conditions. The test holes were drilled to a maximum depth of 22.1 metres using solid stem augers. Piezometers were installed in all three test holes with the screen portion located within the tills. Test hole logs and piezometer construction details are included in Appendix C. Two test holes were drilled to auger refusal at depths of 18.4 and 22.1 m. Drilling into the bedrock was not attempted as part of the geotechnical investigation.

Based on these test hole logs, the undisturbed soil profile consists of approximately 7 metres of silty clay, underlain by silt and clay till to the maximum depth of investigation. Proximate to the PRPS building, clay fill is present to a maximum depth of 19.5 m. The measured depth to water in these piezometers varied from 5.0 to 5.1 m below grade on June 5, 2007, approximately 6 weeks after the piezometers were installed. Note: At the time of all measurements, groundwater levels were being affected by groundwater pumping underway at the West End Water Pollution Control Centre (WEWPCC). Groundwater levels in the bedrock aquifer were being lowered by 2 to 3 m in association with this pumping. The measured groundwater levels as part of this investigation are therefore not considered representative of normal, non-pumping conditions. Higher groundwater levels will occur when pumping ceases at the WEWPCC.

2.2 Groundwater Test Well Construction

UMA Engineering Ltd. retained the services of Friesen Drilling Ltd. to complete the drilling of test hole TH07-4 to the west of the PRPS building (Drawing No. 01). The test well drilling was completed on June 5, 2007 under the supervision of UMA personnel. A Driller's Report outlining the final test well construction details is provided in Appendix B.

The test well construction consisted of the installation of a 150 mm steel casing to a depth of 23.9 m followed by the drilling of a nominal 150 mm open borehole to a maximum depth of 42.7 m below grade. The observed stratigraphy in this test well consisted of (in descending order): silty clay to a depth of 5.8 m; silt till to a depth of 21.9 m; Amaranth Formation siltstones and sandstones to a depth of 36.6 m; followed by dolomitic limestones to the maximum depth of drilling of 42.7 m. The dolomitic limestones were fractured below a depth of 38.1 m. The measured depth to water in this well upon completion of drilling was 7.5 m below grade. The measured water level in this well is considered representative of the groundwater pressure within the fractured limestone. The field measured chemistry of the groundwater from this well includes: electrical conductivity – 6,900 uS, total dissolved solids – 5,300 ppm, and pH – 8.2.

During the drilling of the test well, the ability of the bedrock formations to transmit water was tested by air-lift pumping. The first test was conducted with the open borehole advanced to a depth of 31.1 m to test the Amaranth Formation. It was found that the formation was only capable of transmitting 0.08 to 0.16 litres per second (lps, 1 to 2 lgpm) indicating that the permeability of the Amaranth Formation is low. A second air-lift pumping test was conducted with the open borehole drilled to 42.7 m. The well was capable of producing 0.16 to 0.30 lps (2 to 4 lgpm) at that depth with the majority of the water interpreted to be coming from the lower fractured limestones. Subsequent testing of the well capacity using a submersible pump confirmed that the well is only capable of producing 0.16 to 0.30 lps.

3.0 ASSESSMENT OF RESULTS

The investigations have confirmed that the following geologic and hydrogeologic conditions are present at this site:

- The upper portion of the soil profile consists of approximately 6 to 7 m of silty clay with no evidence of significant silt or sand layers noted. The clays are moist and do not appear to be capable of transmitting significant volumes of groundwater. The area around the PRPS structure appears to have been backfilled with silty clay that has been logged as being dry to moist. No evidence of significant seepage into the test holes was noted within the fill materials.
- The silty clays are underlain by silt to clay till which has been logged as being dry to moist. No layers of pervious sand or gravel appear to be present within the tills at this location. The standpipe piezometers installed within the tills did accumulate groundwater and therefore the tills are capable of producing some groundwater. The available information indicates that the permeability of the tills is low. The measured groundwater pressure within the tills is at approximatly 5.0 to 5.1 m below grade.
- Bedrock beneath the PRPS site has been confirmed to be located at a depth of 21.9 m below grade, and the upper portion of the bedrock profile consists of low permeability Amaranth Formation siltstones and sandstones. Stony Mountain Formation limestones were encountered at a depth of 36.6 m, and are fractured below a depth of 38.1 m. The fractured limestones are capable of transmitting some groundwater (approximately 0.16 to 0.30 lps (2 to 4 lgpm)). The

measured groundwater pressure within the fractured limestones is 7.5 m below grade, however, this groundwater pressure is being artificially lowered by pumping at the WEWPCC.

Relative to the geotechnical assessment of the potential for base heave to occur, it is reasonable to assume that both the tills and Amaranth Formation siltstones and sandstones will act as aquitards restricting the upward movement of groundwater from the underlying limestones. No evidence of fractures or other permeable pathways have been found that would allow groundwater to move in significant volumes upwards from the limestones. Monitoring of the excavation during construction is recommended to confirm the conditions observed during this investigation. The monitoring should include the inspection of the soils for fractures and/or permeable pathways, and the monitoring for evidence of unusual seepage conditions.

Relative to the potential for seepage to occur laterally into the excavation from the adjoining silty clays or tills, no evidence has been found of the presence of any significant permeable layers or saturated zones within the overburden profile. Some seepage should be expected and standard construction dewatering equipment will be required.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The City of Winnipeg retained UMA Engineering Ltd. to complete the required exploration, testing and assessment of the groundwater conditions at the PRPS site located at 6821 Wilkes Avenue in Winnipeg, MB. Based on the results of this work program, the following conclusions are made:

- The geologic profile beneath the PRPS site consists (in descending order) of: 6 to 7 m of silty clay; silt and clay till to a depth of approximately 21.9 m; Amaranth Formation siltstones and sandstones to a depth of 36.6 m; and, Stony Mountain Formation limestones to the maximum depth of investigation of 42.7 metres. The limestones are fractured below a depth of 38.1 m.
- Significant pervious zones were not encountered in the overburden profile, nor within the tested bedrock profile. The siltstones, sandstones and limestones at the tested location were only capable of transmitting approximately 0.16 to 0.30 lps of groundwater, indicating that the bedrock transmissivity is low. The transmissivity of the bedrock will vary laterally with the degree of fracturing. The pumping test results from 1964 for the well located directly beneath the structure indicate that well was originally capable of sustaining a flow rate of 7.1 lps (94 lgpm) but discussions with site personnel indicate that the well is no longer capable of sustaining that flow rate. The indicated transmissivity based on the 1964 pumping test is approximately 1.7×10^{-3} m^2/s (12,000 USgpd/ft).
- The measured groundwater pressure within the bedrock is approximately 7.5 m below grade. However, groundwater pressures are being affected by pumping at the WEWPCC and will rise when pumping ceases. The groundwater pressure at the time of construction at the PRPS will need to be confirmed.

The following recommendations are made:

- Prior to the start of construction, remeasure the groundwater pressures at the site and obtain updated information on groundwater pressure trends from provincial observation well G05MJ005. Review the geotechnical assessment to confirm that any groundwater pressure changes have not adversely affected the assessment.
- During construction, the soil and water conditions in the excavation should be monitored by site personnel. Any significant variations (pervious soils, unusual seepage) from the conditions observed

during this investigation should be reported to project geotechnical and hydrogeologic personnel so that the significance of these variations on this assessment can be determined and corrective actions taken if required.

- Test well TH07-4 should be retained during construction for use if necessary to depressurize the limestone aquifer. The well should be abandoned upon completion of construction by a licensed well driller.
- Monitor excavation

We thank you for the opportunity to work on this project. Should you have any questions concerning this report, please contact Mr. Blair Moore, P.Eng. at (204) 284-0580.

Sincerely,

UMA ENGINEERING LTD.

Steve Wiecek, P.Geo., P.Eng.
Senior Geological Engineer
Earth & Environmental Division

SJW/dh

REFERENCES

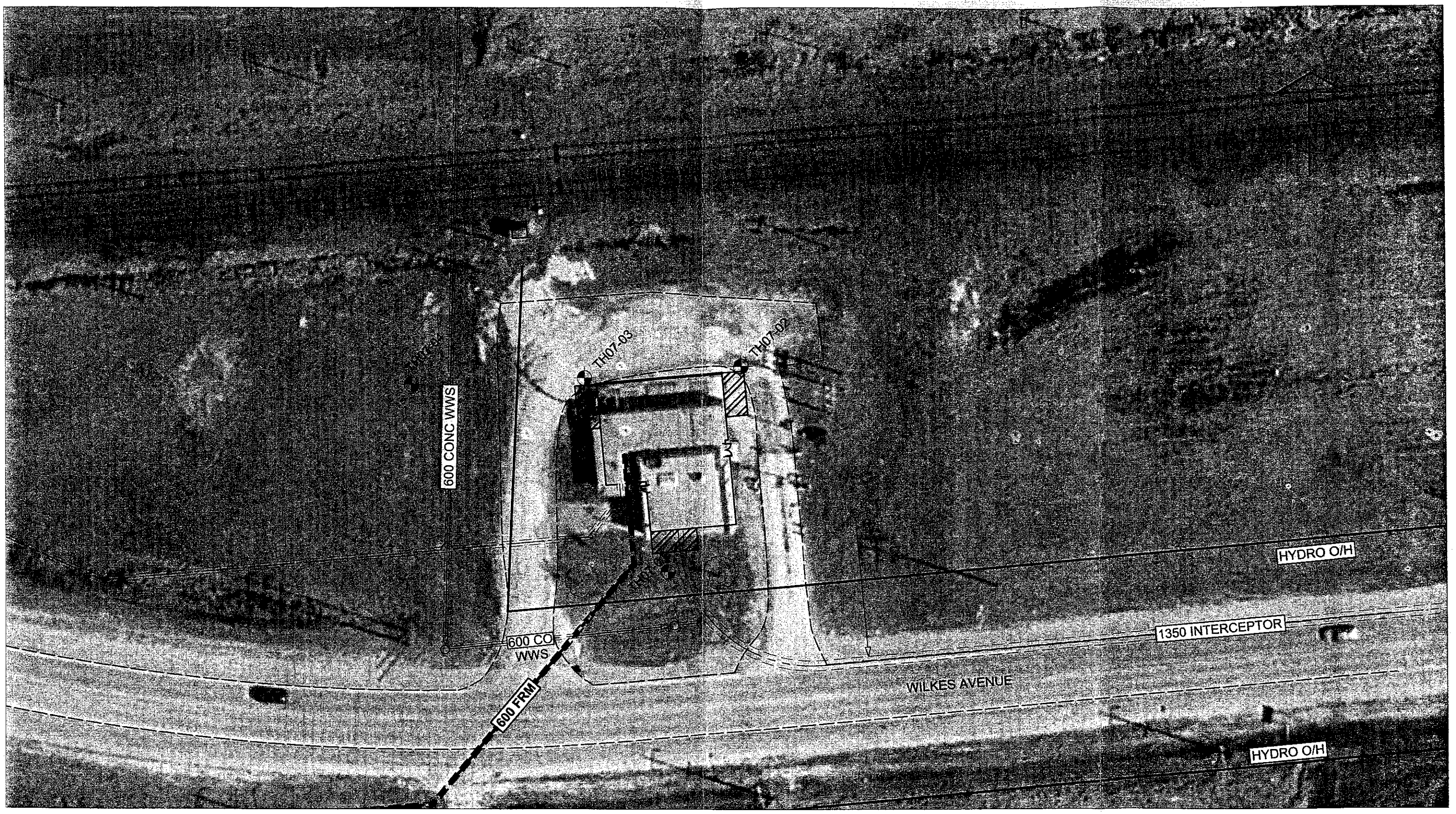
Baracos, A., Shields, D.H., Kjartanson, B. February 1983. Geological Engineering Report for Urban Development of Winnipeg. Winnipeg, Manitoba.

Bezys, R., Bamburak, J., and Conley, G. 2002. Bedrock Mineral Resources of Manitoba's Capital Region. Manitoba Geologic Survey Geoscientific Report GR2002-1.

Manitoba Conservation, 2003. GWDRILL Water Well Records, Water Branch Groundwater Management Section, Winnipeg, MB.

Matille, G. 2004. Surficial Geology, Steinbach, Manitoba, Geological Survey of Canada Map 2056A, Manitoba Geologic Survey Map 2003-8.

DRAWING



PLAN

0 5 10 m SCALE 1:500

City of Winnipeg
Perimeter Road Sewage Pumping Station Reliability
PRPS Upgrades

Test Holes Location Plan

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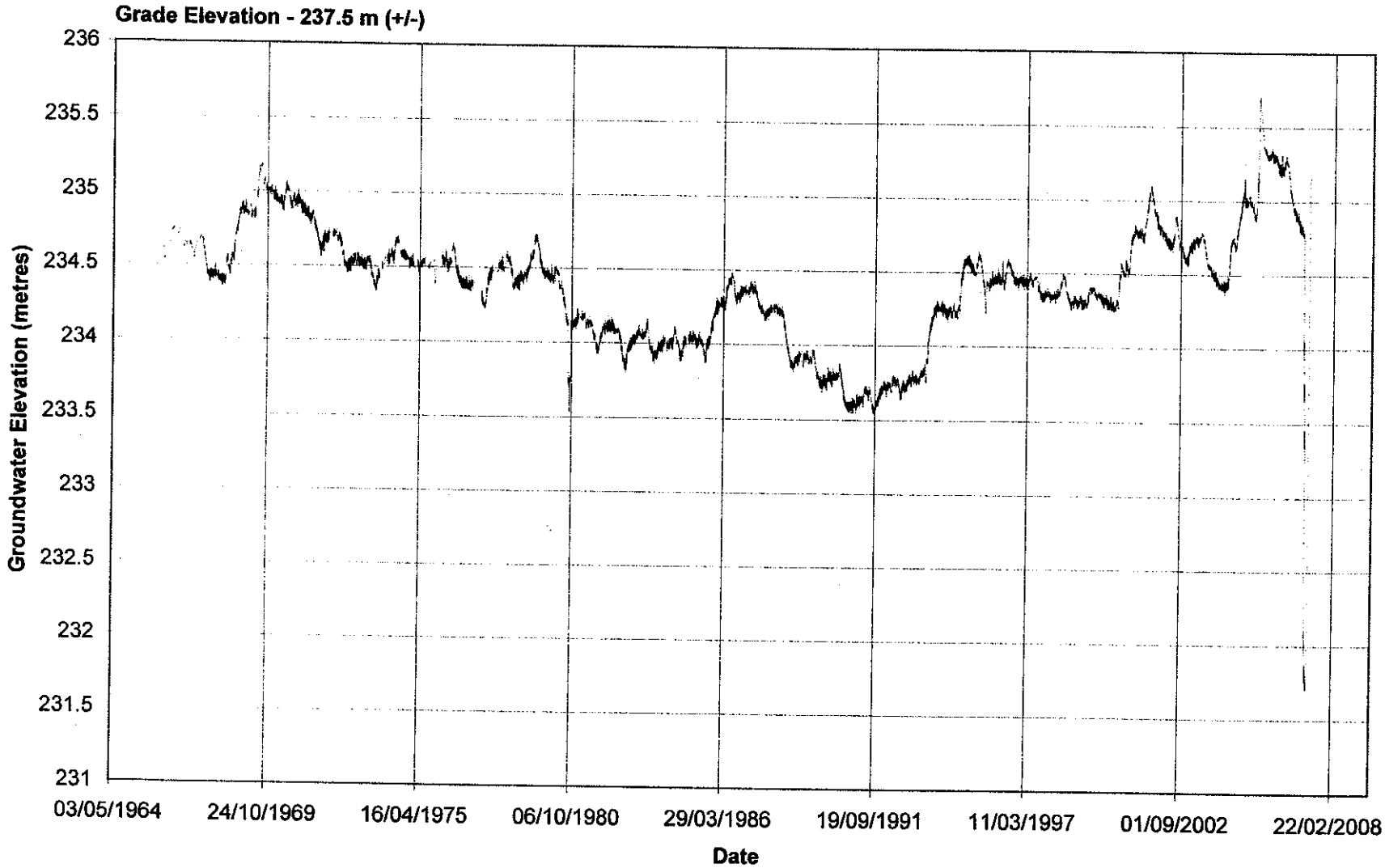
Figure - 01

APPENDIX A

Provincial Observation Well Hydrograph

Groundwater Station G05MJ005
Perimeter Highway And Wilkes Avenue



APPENDIX B

Drillers Reports

(Water Wells)

WELL INFORMATION REPORT

MANITOBA
Manitoba Water Stewardship
Water Branch

2005 Jul 14

LOCATION - RIVER LOT 70 IN PARISH OF St. Charles
Owner - CITY OF WINNIPEG
Driller - WAKSHINSKI, M. Perimeter Road Pumping Station
Well Name -
Well Use - PRODUCTION
Well Status - UNKNOWN
Date Completed - 1964 May 14 Aquifer - LIMESTONE OR DOLOMITE
Top of Casing - 0.0 ft. above ground
Remarks:
EAST JUCTION OF PERIMETER HWY + WILKES AVE, GROUND LEVEL ELEV EST 780 FT

WELL LOG (Imperial units)

From	To(ft.)	Log
0.0	27.5	OLD 6 INCH PIPE
27.5	29.9	REINFORCED CONCRETE SLAB
29.9	30.3	CONCRETE
30.3	32.9	MEDIUM CLAY TILL
32.9	40.9	GREY CLAY TILL
40.9	45.3	WEATHERED LIMESTONE
45.3	72.3	FRACTURED LIMESTONE, CLAY IN CRACKS
72.3	99.2	RED CLAY, SHALE
99.2	127.8	LIMESTONE

WELL CONSTRUCTION

From	To(ft)	Casing	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0.0	49.3	casing	6.0				
49.3	69.0	perforations	5.0			SL. PIPE	
69.0	93.4	casing	5.0				
93.4	127.1	perforations	5.0			SL. PIPE	

PUMPING TEST
Date : 1964 May 14 Pumping 94.0 Imp. gallons/minute
Water level before test : 4.0 ft below ground
Water level at end of test : 22.0 ft below ground
Test duration: 7:00:00 Water temperature: degree(s) F
Test duration: 7:00:00 Water temperature: degree(s) F

WATER USE
Industrial

WELL INFORMATION REPORT

MANITOBA
Manitoba Water Stewardship
Water Branch

2005 Jul 14

LOCATION - RIVER LOT 0072 IN PARISH OF St. Charles
Owner - WRB
Driller - PRUDEN DRILLING CO. LTD.
Well Name - G05MJ005 MO-4
Well Use - OBSERVATION
Date Completed - 1966 Feb 05 Aquifer - SHALE
Top of Casing - 1.2 ft above ground
Remarks:
175 FT N OF PR 427, .2 MI W OF HWY 101, SE OF GRAIN ELEVATOR
CHEMICAL ANALYSIS, GROUND LEVEL ELEV MEASURED 238.405 M

WELL LOG (Imperial units)

From	To(ft.)	Log
0.0	13	CLAY
13.0	35	TILL
35.0	43	CARBONATE BEDROCK
43.0	56	SHALE

WELL CONSTRUCTION

From	To(ft)	Casing	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0.0	35.0	casing	5.0				IRON
35.0	56.0	open hole	4.5				

APPENDIX C

Geotechnical Test Hole Logs

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-1**
LOCATION: South Side of Wilkes Pumping Station N 5,522,058.9 E 620,794.5		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker SS2, 125 mm dia. SSA	ELEVATION (m): 238.353

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PLASTIC / M.C. / LIQUID (20 40 60 80)	COMMENTS	ELEVATION (m)
0	TOPSOIL - trace organics (rootlets), black					238
	CLAY (Fill) - silty - light brown - stiff, moist - medium to high plasticity		G129			
1						237
	- trace sand, trace gravel, firm below 1.5 m		G130			
2						236
3	- brown, firm to stiff, trace silt pockets below 3.0 m					235
4			G131			234
5						233
6			G132			232
	- trace till inclusions					
7	SILT (Till) - some clay, some sand, trace gravel - brown - moist - low to non plastic		G133			231
8	- dry below 8.2 m					230
			G134			
9						229
10	CLAY (Till) - silty, some sand, trace gravel - red - dry to moist - trace of gypsum, white fine grained - medium plasticity		G135			228
11						227
12			G136			226
13	- light brown/red, dry below 12.8 m					

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LOGGED BY: S. Peters	COMPLETION DEPTH: 15.24 m
REVIEWED BY:	COMPLETION DATE: 18/4/07
PROJECT ENGINEER: Faris Khalil	Page 1 of 2

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-1**
LOCATION: South Side of Wilkes Pumping Station N 5,522,058.9 E 620,794.5		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker SS2, 125 mm dia. SSA	ELEVATION (m): 238.353

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PLASTIC / M.C. / LIQUID (20 40 60 80)	COMMENTS	ELEVATION (m)
13			- dry to moist below 13.7 m		G137			225
14								224
15					G138			223
16			END OF TEST HOLE AT 15.2 m Notes: 1. Slougthing at 14.6m. 2. No seepage observed. 3. Installed standpipe at 15.2 m, with flush mount cover. 4. Backfilled test hole with sand to 13.1 m, bentonite chips to 10.1 m and auger cuttings to surface. 5. Water level at 5.80 m below ground surface on May 1, 2007.					222
17								221
18								220
19								219
20								218
21								217
22								216
23								215
24								214
25								213
26								

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 15.24 m
REVIEWED BY:	COMPLETION DATE: 18/4/07
PROJECT ENGINEER: Faris Khalil	Page 2 of 2

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-2**
LOCATION: North East corner of Wilkes Pumping Station N 5,522,087.2 E 620,804.7		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.305

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	ELEVATION (m)
0	SAND (Fill) - some gravel, trace silt - brown, moist			238
1	CLAY (Fill) - silty, trace gravel - black - frozen to ~1.8 m - low to medium plasticity - organic odour		G113	237
2	- firm to stiff, moist, below 1.8 m			236
3	- some silt inclusions, trace organics, grey, medium to high plasticity, organic odour below 2.4 m		G114 T115	235
4			G116	234
5	- firm below 4.6 m			233
6			G117	232
7	- trace sand, dry to moist, silt seams (~1mm thick)		T118	231
8	- trace organics, grey to black, some red, firm to stiff, medium to high plasticity - organic odour		G119	230
9	- red below 7.9 m - trace gypsum, white fine grained		G120	229
10			T121	228
11			G122	227
12	- stiff to very stiff below 11.0 m - dry to moist			226
13	CLAY - silty, trace sand, trace fine gravel - brown - stiff to very stiff, dry - low to medium plasticity		G123	

Δ Pocket Pen. (Su) Δ (kPa): 50 100 150 200

■ Total Unit Wt ■ (kN/m³): 17 19 21 23

PLASTIC M.C. LIQUID: 20 40 60 80

× QU (Su) × (kPa): 50 100 150 200

+ Torvane (Su) + (kPa): 50 100 150 200

COMMENTS

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 22.10 m
REVIEWED BY:	COMPLETION DATE: 16/4/07
PROJECT ENGINEER: Faris Khalil	Page 1 of 2

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-2**
LOCATION: North East corner of Wilkes Pumping Station N 5,522,087.2 E 620,804.7		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.305

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	Δ Pocket Pen. (Su) Δ (kPa) 50 100 150 200 / ■ Total Unit Wt ■ (kN/m³) 17 19 21 23 / PLASTIC M.C. LIQUID 20 40 60 80	×QU (Su)× (kPa) 50 100 150 200 / + Torvane (Su) + (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
13					G124				225
14			- grey below 14.0 m						224
15					G125				223
16									222
17					G126				221
18									220
19									219
20			CLAY (Till) - silty, some sand, trace gravel, trace organics - brown - moist - medium plasticity		G127				218
21									217
22					G128				216
23			END OF TEST HOLE AT 22.1 m Notes. 1. Power auger refusal at 22.1 m. 2. No sloughing observed. 3. No seepage observed. 4. Installed standpipe at 22.1 m, with flush mount cover. 5. Backfilled test hole with sand to 20.6 m, bentonite chips to 17.5 m and auger cuttings to surface 6. Water level at 5.38 m below ground surface on May 1, 2007.						215
24									214
25									213
26									

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 22.10 m
REVIEWED BY:	COMPLETION DATE: 16/4/07
PROJECT ENGINEER: Faris Khalil	Page 2 of 2

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-3**
LOCATION: North West corner of Wilkes Pumping Station N 5,522,085.4 E 620,783.2		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.304

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	ELEVATION (m)
0	SAND (Fill) - some gravel, trace silt - brown, moist				238
1	CLAY (Fill) - silty, trace gravel, trace rootlets - black to dark brown - frozen to ~1.5 m - organic odour		G100		237
2	- some silt inclusions, grey, firm to stiff, moist, medium to high plasticity below 1.5 m - trace gypsum, white fine grained near 1.5 m		G101		236
3			T102		235
4			G103		234
5	- trace rootlets, silt seems, stiff, organic odour below 4.6 m		T104		233
6			G105		232
7			G106		231
8	- some red below 7.9 m				230
9	- trace gypsum, white fine grained at 8.8 m - trace organics - organic odour		G107		229
10			G108		228
11	- trace organics, silt seems, black at 10.4m - red below 10.7 m				227
12			G109		226
13					

Pocket Pen. (Su) (kPa): 50 100 150 200

Total Unit Wt (kN/m³): 17 19 21 23

PLASTIC M.C. LIQUID: 20 40 60 80

QU (Su) (kPa): 50 100 150 200

Torvane (Su) (kPa): 50 100 150 200

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 18.39 m
REVIEWED BY:	COMPLETION DATE: 16/4/07
PROJECT ENGINEER: Faris Khalil	Page 1 of 2

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-3**
LOCATION: North West corner of Wilkes Pumping Station N 5,522,085.4 E 620,783.2		PROJECT NO.: D265 202 02
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Acker MP5-T, 125 mm dia. SSA	ELEVATION (m): 238.304

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	ELEVATION (m)
13				225
14	CLAY (Till) - silty, sandy, trace gravel - light grey - dense, dry to moist - trace gypsum, white fine grained			224
15			G110	223
16	- red, moist, compact to dense below 15.5 m			222
17			G111	221
18			G112	220
19	END OF TEST HOLE AT 18.4 m. Notes. 1. Power auger refusal at 18.4 m. 2. Squeezing near 12.2 m 3. Installed standpipe at 18.4 m, with flush mount cover. 4. Backfilled test hole with bentonite chips to 9.1 m and auger cuttings to surface. 5. Water level at 5.31 m below ground surface on May 1, 2007.			219
20				218
21				217
22				216
23				215
24				214
25				213
26				

SLOTTED PIEZOMETER

SOIL SYMBOL

△ Pocket Pen. (Su) △ (kPa) 50 100 150 200

■ Total Unit Wt ■ (kN/m³) 17 19 21 23

PLASTIC M.C. LIQUID 20 40 60 80

× QU (Su) × (kPa) 50 100 150 200

+ Torvane (Su) + (kPa) 50 100 150 200

COMMENTS

UMA | AECOM

LOGGED BY: S. Peters	COMPLETION DEPTH: 18.39 m
REVIEWED BY:	COMPLETION DATE: 16/4/07
PROJECT ENGINEER: Faris Khalil	Page 2 of 2

LOG OF TESTHOLE (OLD) 2007 04 02 WILKES AVE AND PERIMETER TH LOGS.GPJ UMA.GDT 12/9/07

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-4**
LOCATION: 25 m west of north-west corner of PRPS building, 6821 Wilkes Ave.		PROJECT NO.: D265 202 02
CONTRACTOR: Friesen Drillers Ltd.	METHOD: DR-24, 150 mm dia. Casing	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0			CLAY - silty				
6			SILT (Till)				

LOG OF TESTHOLE (OLD) 2007 06 05 WILKES AVE AND PERIMETER_WELL LOG.GPJ UMA.GDT 13/9/07

UMA | AECOM

LOGGED BY: Steve Wiecek	COMPLETION DEPTH: 42.67 m
REVIEWED BY:	COMPLETION DATE: 5/6/07
PROJECT ENGINEER: Steve Wiecek	Page 1 of 4

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-4**
LOCATION: 25 m west of north-west corner of PRPS building, 6821 Wilkes Ave.		PROJECT NO.: D265 202 02
CONTRACTOR: Friesen Drillers Ltd.	METHOD: DR-24, 150 mm dia. Casing	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
13							13
14							14
15							15
16							16
17							17
18							18
19							19
20							20
21							21
22			ANARANTH FORMATION - siltstones and sandstones - white to light brown to 88' - red from 88' to 120'				22
23							23
24							24
25							25
26							

LOG OF TESTHOLE (OLD) 2007 06 05 WILKES AVE AND PERIMETER_WELL LOG.GPJ UMA.GDT 13/9/07

UMA | AECOM

LOGGED BY: Steve Wiecek	COMPLETION DEPTH: 42.67 m
REVIEWED BY:	COMPLETION DATE: 5/6/07
PROJECT ENGINEER: Steve Wiecek	Page 2 of 4

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-4**
LOCATION: 25 m west of north-west corner of PRPS building, 6821 Wilkes Ave.		PROJECT NO.: D265 202 02
CONTRACTOR: Friesen Drillers Ltd.	METHOD: DR-24, 150 mm dia. Casing	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
26							26
27							27
28							28
29							29
30							30
31							31
32							32
33							33
34							34
35							35
36							36
37			DOLORITE LIMESTONE - fractures below 125'				37
38							38
39							

LOG OF TESTHOLE (OLD) 2007 06 05 WILKES AVE AND PERIMETER_WELL LOG.GPJ UMA.GDT 13/9/07

UMA | AECOM

LOGGED BY: Steve Wiecek	COMPLETION DEPTH: 42.67 m
REVIEWED BY:	COMPLETION DATE: 5/6/07
PROJECT ENGINEER: Steve Wiecek	Page 3 of 4

PROJECT: PRPS Reliability - PRPS Upgrades	CLIENT: City of Winnipeg	TESTHOLE NO: **TH07-4**
LOCATION: 25 m west of north-west corner of PRPS building, 6821 Wilkes Ave.		PROJECT NO.: D265 202 02
CONTRACTOR: Friesen Drillers Ltd.	METHOD: DR-24, 150 mm dia. Casing	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
39							
40							40
41							41
42							42
43			END FO TEST HOLE				43
44							44
45							45
46							46
47							47
48							48
49							49
50							50
51							51
52							

LOG OF TESTHOLE (OLD) 2007 06 05 WILKES AVE AND PERIMETER_WELL LOG.GPJ UMA.GDT 13/9/07

UMA | AECOM

LOGGED BY: Steve Wiecek	COMPLETION DEPTH: 42.67 m
REVIEWED BY:	COMPLETION DATE: 5/6/07
PROJECT ENGINEER: Steve Wiecek	Page 4 of 4