Parks Canada Parcs Canada

SPECIFICATIONS

CYPRUS LAKE CAMPGROUND RENEWAL HUB AMENITY CENTRE

PROJECT 947

June 19, 2018

ISSUED FOR TENDER

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Title and description of work.

.2 Work by others.

.3 Work sequence.

.4 Contractor use of premises.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work generally but not limited to this Contract is for the construction of a new amenity building, parking lot, outdoor enclosed garbage area, generator and propane tank, all the servicing, removals, utility implementations, grading works, demolition and removal of existing rock formations. Work in the new building includes 16 shower stalls, washrooms, storage areas, staff work room, tuck shop, interpretative room, electrical power and lighting, mechanical and plumbing systems, architectural, structural and site work. Additionally amenities shall be implemented for passive and active recreation opportunities as well as a waste water treatment facility.

.2 Please refer to the drawings.

1.3 WORK BY OTHERS

.1 The following are specifically excluded from this Contract:

.2 The supply and installation of furnishings are not part of this contract unless specifically noted in the documents.

.3 Tree clearing and grubbing shall be undertaken by Parks Canada staff. Any additional tree clearing deemed necessary for construction means and methods shall be conducted by the general contractor.

1.4 LOCATION OF THE SITE

.1 The Project Site is located on Cyprus Lake opposite the entrance to the Birches Campground in the Bruce Peninsula National Park

.2 The Bruce Peninsula National Park is located on the east and west side of the Bruce Peninsula, approx. 19km from Tobermory, Ontario which is accessed off Highway 6 from Owen Sound.

1.5 SITE ACCESS

.1 The site can only be accessed from land.

1.6 WORK SEQUENCE

.1 Construct work in stages to accommodate Owner's Seasonal operation.

.1 Pre-construction meeting will be tentatively scheduled for August 15th, 2018

.2 Clearing and grubbing for the proposed parking lot and building sites shall be completed by Parks Canada.

.2 The Contractor shall have all work including amenity building, site works, parking lot and commissioning completed by March 31, 2020.

.3 The construction schedule must be submitted by the Contractor and approved by the Department Representative two weeks prior to construction mobilization and start up.

1.7 CONTRACTOR USE OF PREMISES

.1 Contractor has unrestricted use of the construction site until Substantial Performance.

.2 Contractor shall limit use of premises for Work, to allow:

.1 Partial owner occupancy.

.2 Work by other contractors.

.3 Coordinate use of the premises under direction of Department Representative.

.4 Obtain and pay for use of additional storage or work areas needed for operation under this Contract.

1.8 EXISTING SERVICES

.1 Notify Consultant and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Consultant 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian and vehicular traffic.

.3 Provide alternative routes for personnel and/or pedestrian and vehicular traffic if required.

.4 Establish location and extent of service lines in area of work before starting Work. Notify the Department Representative and Consultant of findings.

.5 Submit schedule to and obtain approval from Consultant for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services when directed by the Department Representative/Consultant to maintain critical building and tenant systems.

.7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

.8 Where unknown services are encountered, immediately advise the Department Representative Consultant and confirm findings in writing.

.9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.10 Record locations of maintained, re-routed and abandoned service lines.

.11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.9 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed Shop Drawings.

.5 List of Outstanding Shop Drawings.

.6 Change Orders.

.7 Other Modifications to Contract.

.8 Field Test Reports.

.9 Copy of Approved Work Schedule.

.10 Health and Safety Plan and Other Safety Related Documents.

.11 Other documents as specified.

1.10 REFERENCES AND CODES

.1 National Building Code of Canada (NBC) 2015 including all amendments up to closing date.

.2 Ontario Provincial Standard Specifications (OPSS) including all amendments up to the closing date.

.3 Perform work in accordance with National Building Code of Canada (NBC) and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.4 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.11 HAZARDOUS MATERIAL DISCOVERY

.1 Not Used.

1.12 BUILDING SMOKING ENVIRONMENT

.1 Smoking is prohibited in all workplaces within Parks Canada buildings.

.2 Although smoking is not permitted in hazardous areas, care must still be exercised in the use of smoking materials in non-restricted areas.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 APPROVED ALTERNATES AND APPORVED EQUIVALENT

.1 Named Products alternates or equals, indicated by the phrases "or approved alternate by XYZ Manufacturing" or "or approved equal by XYZ Manufacturing", shall be interpreted to mean that named Product alternate or equal, if selected for use in lieu of indicated or specified Product, meets or exceeds performance, appearance, general arrangement, dimensions, availability, code and standards compliance, and colour of specified Product.

.2 Be responsible for costs and modifications associated with the inclusion of named Product alternate or equal at no additional cost to the Owner.

.3 The process for proposing and approving alternates or equals, including alternate design solutions, shall be the same process as for proposing and approving substitutions (refer to paragraph 1.2 below).

.4 Confirm delivery of specified items prior to proposing alternates or equals.

1.2 SUBSTITUTIONS

.1 Submission of substitutions:

.1 Proposals for substitutions of Products and materials must be submitted in accordance with procedures specified in this section.

.2 Consultant may review submissions, if directed by Owner, but in any case with the understanding that the Contract Time will not be altered due to the time required by the Consultant to review the submission and by the Contractor to implement the substitution in the Work.

.2 Submission requirements:

.1 Description of proposed substitution, including detailed comparative specification of proposed substitution with the specified Product.

.2 Manufacturer’s Product data sheets for proposed Products.

.3 Respective costs of items originally specified and the proposed substitution.

.4 Confirmation of proposed substitution delivery, in writing by Product manufacturer.

.5 Compliance with the building codes and requirements of authorities having jurisdiction.

.6 Affect concerning compatibility and interface with adjacent building materials and components.

.7 Compliance with the intent of the Contract Documents.

.8 Effect on Contract Time.

.9 Reasons for the request.

.3 Substitutions submitted on shop drawings without following requirements of this section prior to submission of the affected shop drawings will cause the shop drawings to be rejected.

.4 Proposed substitutions shall include costs associated with modifications necessary to other adjacent and connecting portions of the Work.

.5 Consultant’s decision concerning acceptance or rejection of proposed substitutions is final. Should it appear to the Consultant that the value of services required to evaluate the substitution exceeds the potential reduction, the Consultant will advise the Owner that the substitution does not merit consideration before proceeding with a full evaluation. If the substitution will produce a reduction commensurate with or exceeding the value of the Consultant’s services to evaluate the substitution, the Consultant will request the Owner’s direction to proceed with evaluation.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 RELATED SECTIONS & DOCUMENTS

.1 Section 01 29 83 Payment Procedures for Laboratory Testing

.2 Section 01 31 00 Project Management and Coordination

.3 Section 01 78 00 Closeout Submittals

.4 Section 01 79 00 Demonstration & Training

1.2 SECTION INCLUDES

.1 This section specifies the administrative and procedural requirements governing following:

.1 Payment

.2 Schedule of Values

.3 Application for Payment

.4 Holdback

1.3 PAYMENT

.1 Method of Payment

.1 The supply of all materials, labour, tools, equipment, protection, transportation, customs, administrative costs, profits, financing, etc. as necessary to perform the work of this contract are included with the items listed on the tender form, unless otherwise indicated.

.2 Costs associated with work for Division 1 and mobilization & demobilization, shall be included in the costs for the items identified on the tender form.

.3 Contractors shall provide a schedule of values in the divisional master format per the spec sections and then provide supplemental unit rate adds and subtracts to items that are relevant.

.4 All items in this contract to be paid by costs included in the unit prices and lump sum payments. Cost not included in the unit prices shall be included in the lump sum payments.

.5 The Lump Sum Items listed below shall be included in the appropriate division as presented on the Schedule of Value bid form:

.1 **Demolition & Removals:** The lump sum price bid shall include all costs to complete the works shown on the Removals Drawing (D1) including clearing and grubbing, rock excavation, top soil/organic material stripping, all removals, replacements, demolition, disposal and implementation of the erosion and control measures.

.2 **Site Related Implementation Items:** The installation of the parking lot with permeable paving, regular and stamped concrete paving walkways, drainage works, parking lot and exterior pedestrian lighting, wood fence enclosures, pavement markings, active and passive amenities, propane fire pit and amphitheatre shall be lump sum price bid and shall include all costs to install the works noted above including but not limited to solar powered parking lot lights, ditching, wood posts, and rope, swales, culverts, excavation, backfill, grading, placement of fill, as shown on the drawings. Costs for the placement of Granular A, Granular B and Asphalt are included in the supplemental unit adds and subtract price table below.

.3 **Extension of Utilities and New Servicing:** The lump sum price bid shall include all costs to extend services and install new services as shown on the drawings,

including all connections and rock removal for water servicing, well installation and electrical servicing.

.4 **Waste Water and Sanitary Servicing:** The lump sum price bid shall include all costs to extend the sanitary service from the Amenity Building to the waste water system and install a new Waterloo Bio Filter waste water system as shown on the drawings, including all connections, rock removal for tank installations and electrical service.

.5 **Construction of the New Amenity Building, Storage Area, Staff Area, Tuck Shop, Interpretation Room and Breezeway:** The lump sum price bid shall include all costs for labour, material and equipment for the construction of the building including excavation, backfill, foundation, framing, electrical, mechanical and finishes, as shown on the drawings. The lump sum price bid shall include all costs for a fully functional and finished system in accordance with design contract drawings and specifications, all to the satisfaction of the Department Representative.

.6 **Construction of the Utility Drainage Field (Leaching Bed):** The lump sum price bid shall include all costs to excavate, rock removal, shaping, place and compact layers of leaching materials as well as all necessary drainage piping**,** topsoil and seeding.

.7 **Planting:** The lump sum bid price shall include all labour, materials, equipment and delivery of plant materials and plant mix to install all planting material as noted on the planting plans and details.

.6 The Supplemental Unit Price Items for adds and subtracts presented on the bid form are:

.1 Supply all labour, materials, place & compact 300 mm of Granular ‘B’: Payment for the placement of Granular ‘B’ shall be per tonne.

.2 Supply all labour, materials, place & compact 200 mm of Granular ‘A’: Payment for the placement of Granular ‘A’ shall be per tonne.

.3 Supply all labour, materials, place & compact Hot Mix Asphalt: Payment for the placement of Hot Mix Asphalt shall be per tonne.

.4 Supply, all labour, materials, place & compact granular base material, in fill drainage material and permeable precast concrete paving and edge restraint. Payment for the permeable precast concrete paving shall be per square meter.

.5 Supply, all labour, materials, place & compact granular base material and rough stone textured concrete. Payment for the concrete paving shall be per square meter.

1.4 SCHEDULE OF VALUES

.1 Submit the initial Schedule of Values to the Department Representative at least two (2) weeks before the initial Application for Payment.

.2 The Schedule of Values shall be broken down by Division or Specification or per the Tender Form. Use the Summary of Divisions and Specifications (Table of Contents) as a guide to determine the organization of the division names and numbers. The Schedule of Values shall be in a format acceptable to the Department Representative.

.3 For each Division:

.1 For all work completed by the General Contractor, provide a line item description of the work, the dollar amount allocated and the actual amount expended.

.2 For each subcontract, provide an itemized listing of the subcontractor name, description of work and the contract amount.

.4 Changes in the cost allocation shall be approved in writing by the Department Representative. Any approved changes shall be explicitly noted on the Schedule of Values. Include a copy of the Owner's written approval for such changes in the Application for Payment.

.5 Provide a separate line item for each Change Order to the Contract. Do not allocate cost of change orders to the breakdown of the original contract.

.6 The allocation of costs in the Schedule of Values must be approved by the Department Representative before an application for payment is made.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

.1 Particular requirements for inspection and testing to be carried out by testing laboratory approved by the Department Representative are specified under various sections.

1.2 APPOINTMENT AND PAYMENT

.1 The Department Representative will pay for services of testing laboratory except as follows:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.

.4 Mill tests and certificates of compliance.

.5 Tests specified to be carried out by Contractor under the supervision of the Department Representative.

.6 Additional tests specified in the following paragraph.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, Contractor to pay costs for additional tests or inspections as required by the Department Representative to verify acceptability of corrected work.

1.3 CONTRACTORS RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:

.1 Provide access to Work to be inspected and tested.

.2 Facilitate and coordinate inspection and tests.

.3 Make good Work disturbed by inspection and test.

.2 Notify the Department Representative sufficiently in advance of operations to allow for the Department Representative to review the scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by the Department Representative.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 PROJECT MEETINGS

.1 The Department Representative will arrange project meetings in coordination with AECOM. The Department Representative will assume responsibility for setting times, recording and distributing meeting minutes.

1.2 ON-SITE DOCUMENTS

.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 Change orders.

.6 Other modifications to Contract.

.7 Field test reports.

.8 Copy of approved work schedule.

.9 Manufacturer's installation and application instructions.

1.3 SCHEDULES

.1 Contractor to submit a construction progress schedule to the Department Representative within 10 working days of the Contract award and at least 10 working days prior to the submission of the first progress claim. The construction progress schedule must show anticipated progress stages as well as anticipated submittal dates for all samples, shop drawings etc. to be submitted and final completion of the work within the time periods required by the Contract documents.

.2 During progress of Work revise and resubmit as directed by the Department Representative.

1.4 CLOSEOUT PROCEDURES

.1 Notify the Department Representative when Work is considered ready for Substantial Performance.

.2 Accompany the Department Representative on preliminary inspection to determine items listed for completion or correction.

.3 Comply with the Department Representative's instructions for correction of items of Work listed in executed Certificate of Substantial Performance and for access to Owner- occupied areas.

.4 Notify the Department Representative of completion of items of Work determined in the Department Representative's final inspection.

1.5 PAYMENTS / SCHEDULE OF VALUES

.1 The Contractor shall submit a Schedule of Values to the Department Representative at least two (2) weeks prior to the first application for payment. Submit the Schedule of Values as per Section 01 29 00 Payment Procedures.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples.

1.2 ADMINISTRATIVE

.1 Submit to the Department Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as not to cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Work affected by submittal shall not proceed 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.

.5 Review submittals prior to submission to the Department Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated 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 shall be considered rejected.

.6 Notify the Department Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are coordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by the Department Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Department Representative's review.

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

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

.3 Allow 10 working days for the Department Representative's review of each submission.

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

.5 Make changes in shop drawings as the Department Representative may require, consistent with Contract Documents. When resubmitting, notify the Department Representative in writing of any revisions other than those requested.

.6 Delete information not applicable to project.

.7 Accompany submissions with transmittal letter 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 shall 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 Submit minimum of 7 prints of shop drawings for each requirement requested in specification Sections and as the Department Representative may reasonably request with the understanding the Department Representative will retain 3 copies of the reviewed submission

.10 Submit minimum of 7 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by the Department Representative where shop drawings will not be prepared due to standardized manufacture of product, with the understanding the Department Representative will retain 3 copies of the reviewed submission.

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

.12 If upon review by the Department Representative, 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.

.13 The review of shop drawings by the Department Representative is for sole purpose of ascertaining conformance with the general concept. This review shall not mean that the Department Representative approves detail design inherent in shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve

Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting generally the 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 coordination of Work of all sub-trades.

.14 After the Department Representative's review, distribute copies.

1.4 SAMPLES

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

.2 Notify the Department Representative in writing at time of submission of deviations in samples from requirements of Contract Documents.

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

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

.5 Make changes in samples which the Department Representative may require, consistent with Contract Documents.

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

1.5 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00 – Quality Control.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

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

.1 Material Safety Data Sheets (MSDS)

.3 Province of Ontario

.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. [latest version].

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit site-specific Health and Safety Plan within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to the Department Representative weekly for information and record purposes only.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS – Material Safety Data Sheets.

.7 The Department Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to the Department Representative within 5 days after receipt of comments from the Department Representative.

.8 The Department Representative's review of Contractor's final Health and Safety Plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to the Department Representative.

.10 On-site contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 OF NOTICE

.1 File Notice of Project with Departmental Representative prior to beginning of Work.

1.4 SAFETY ASSESSMENT

.1 Perform the site specific safety hazard assessment related to project.

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with Department Representative prior to commencement of Work.

1.6 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Department Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.7 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.8 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Health and Safety Act and Regulations for Construction Projects, R.S.O.

.2 Comply with Occupational Health and Safety Regulations, 1996.

.3 Comply with Canada Labour Code, Canada Occupational Health and Safety Regulations.

1.9 UNFORESEEN HAZARDS

.1 When unforeseen peculiar safety-related factor, hazard or condition occurs during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction, and advise Department Representative verbally and in writing.

1.10 HEALTH AND SAFETY COORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:

.1 Have minimum 2 year's site-related working experience specific to activities associated with this project.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to, and be under direction of, site supervisor.

1.11 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations and in consultation with the Department Representative.

1.12 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by the Department Representative.

.2 Provide the Department Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 The Department Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.13 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 FIRE SAFETY BRIEFING

.1 Contractor will coordinate arrangements for briefing on Fire Safety at their pre-work conference with Department Representative before any work is commenced.

1.2 REPORTING FIRES

.1 Know location of nearest fire alarm box and telephone, including emergency phone number.

.2 Report immediately all fire incidents to Fire Department as follows:

.1 Activate nearest fire alarm box; or

.2 Telephone.

.3 Person activating fire alarm box will remain at box to direct Fire Department to scene of fire.

.4 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify location.

1.3 INTERIOR AND EXTERIOR FIRE PROTECTION AND ALARM SYSTEMS

.1 Fire protection and alarm system will not be:

.1 Obstructed;

.2 Shut-off; and

.3 Left inactive at end of working day or shift without authorization from the Department Representative.

.2 Standpipes and hose systems will not be used for other than fire-fighting purposes unless authorized by the Department Representative.

1.4 FIRE EXTINGUISHERS

.1 Supply fire extinguishers, necessary to protect work in progress and contractor's physical plant on site.

1.5 BLOCKAGE OF ROADWAYS

.1 Advise the Department Representative of any work that would impede fire apparatus response. This includes violation of minimum overhead clearance, as prescribed by Department Representative, erecting barricades and digging of trenches.

1.6 SMOKING PRECAUTIONS

.1 Smoking is prohibited in all work places within Parks Canada buildings.

.2 Although smoking is not permitted in hazardous areas, care must still be exercised in the use of smoking materials in non-restricted areas.

1.7 RUBBISH AND WASTE MATERIALS

.1 Rubbish and waste materials are to be kept to a minimum.

.2 Burning of rubbish is prohibited.

.3 Removal:

.1 Remove all rubbish from work site at end of work day or shift as directed.

.4 Storage:

.1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.

.2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove as required in Section 1.8.

1.8 FLAMMABLE AND COMBUSTIBLE LIQUIDS

.1 Handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.

.2 Flammable and combustible liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires permission of the Department Representative.

.3 Transfer of flammable and combustible liquids is prohibited within buildings or jetties.

.4 Transfer of flammable and combustible liquids will not be carried out in vicinity of open flames or any type of heat-producing devices.

.5 Flammable liquids having a flash point below 38°C such as naphtha or gasoline will not be used as solvents or cleaning agents.

.6 Flammable and combustible waste liquids for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and Fire Department is to be notified when disposal is required.

1.9 HAZARDOUS SUBSTANCES

.1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, will be in accordance with National Fire Code of Canada.

.2 Obtain from the Department Representative a "Hot Work" permit for work involving welding, burning or use of blow torches and salamanders in buildings or facilities.

.3 When Work is carried out in dangerous or hazardous areas involving use of heat, provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of the Department Representative. Contractors are responsible for providing fire watch service for work on a scale established and in conjunction with Department Representative at pre-work conference.

.4 Where flammable liquids, such as lacquers or urethanes are to be used, proper ventilation will be assured and all sources of ignition are to be eliminated. The Department Representative is to be informed prior to and at cessation of such work.

1.10 QUESTIONS AND/OR CLARIFICATION

.1 Direct any questions or clarification on Fire Safety in addition to above requirements to the Department Representative.

1.11 FIRE INSPECTION

.1 Site inspection by the Department Representative will be coordinated through the Department Representative.

.2 Allow Fire Chief unrestricted access to work site.

.3 Cooperate with Department Representative during routine fire safety inspection of work site.

.4 Immediately remedy all unsafe fire situations observed by Department Representative.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 FIRES

.1 Fires and burning of rubbish on site are not permitted.

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site unless approved by the Department Representative.

.2 Do not dispose of waste or volatile materials such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into existing fen areas, sand dune areas, waterways, sewer or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and all plants on site and adjacent properties where indicated.

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2m.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Restrict tree removal to areas indicated or designated by the Department Representative.

1.5 WORK ADJACENT TO WATERWAYS

.1 Do not operate construction equipment in waterways.

.2 Do not use waterway beds for borrow material without the Department Representative's approval.

.3 Do not dump excavated fill, waste material or debris in waterways.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.7 Do not blast under water or within 100m of indicated spawning beds.

1.6 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Refuelling shall be completed on hard surfaces and a minimum of 50m from water bodies.

.6 Equipment shall be maintained in good working order. Equipment and heavy machinery used shall meet or exceed all applicable emission requirements.

.7 Ensure spill containment equipment is available on site.

.8 Prevent any and all hydrocarbons from entering the ground.

.9 Minimize noise levels from construction activities by using proper muffling devices, in addition to appropriate timing and location of these activities to reduce minimize the effect of noise on nearby residents, recreationists and wildlife.

1.7 WILDLIFE PROTECTION

.1 Eastern Massassauga Rattlesnake, Northern Ribbon Snake and Eastern Milksnake are species at risk and cannot be harmed. If they are found on site, please contact the Departmental Representative so that Parks Canada staff can relocate them away from the site.

.2 Turtles shall not be harmed. If they are found on site, please contact the Departmental Representative so that Parks Canada staff can relocate them away from the site.

1.8 SUBMITTALS

.1 Within 10 days prior to commencing construction activities or the delivery of materials to the site, provide an Environmental Protection Plan for the review and approval of the Department Representative. The Environmental Protection Plan shall include a comprehensive overview of known or potential environmental issues to be addressed during construction.

.2 Address the topics at a level of detail relative with the environmental issue and required construction tasks.

.3 The following shall be included in the Environmental Protection Plan:

.1 Names of persons responsible for ensuring adherence to the Environmental Protection Plan.

.2 Names and qualifications of persons who are responsible for the training of the site personnel.

.3 Erosion & Sediment Control Plan shall be followed as provided by parks Canada including monitoring and reporting requirements to assure that control measures are in compliance with the erosion and sediment control plan.

.4 Spill Control Plan including procedures, instructions and reports to be used in the event of unforeseen spill of regulated substances.

.5 Contaminant Prevention Plan identifying potentially hazardous substances to be used on the job site; intended actions to prevent the introduction of hazardous substances into the air, water or ground; and detailing provisions for compliance with Federal, Provincial and Municipal laws and regulations for the storage and handling of these materials.

1.9 NOTIFICATION

.1 The Department Representative will notify the Contractor in writing of any observed non compliance with the Environmental Protection Plan, Federal, Provincial or Municipal Environmental laws or regulations, and permits.

.2 After the receipt of such notification, the Contractor shall inform the Department Representative of the proposed corrective action and take such action for approval of the Department Representative.

.3 The Departmental Representative will issue a stop work order until satisfactory corrective action has been taken.

.4 No time extension will be granted or no equitable adjustments allowed to the Contractor for such suspensions.

2 Products

Not Used

3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

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

.2 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.

.3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

.5 Waste Management: separate waste materials for reuse / recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Inspection and testing.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Mill tests.

.5 Equipment and system adjust and balance.

1.2 INSPECTION

.1 Allow the Department Representative access to Work. If part of Work is in preparation at location other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by the Department Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 The Department Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contact Documents.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by the Department Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Owner.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, the appointed agency will request additional testing to ascertain full degree of defect. The Contractor shall correct defect and irregularities as advised by the Department Representative at no cost to Owner. The Contractor shall pay costs for retesting and re-inspection.

1.4 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, offsite manufacturing and fabrication plants.

.2 Cooperate to provide reasonable facilities for such access

1.5 PROCEDURES

.1 Notify appropriate agency and the Department Representative in advance of requirements for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Department

Representative as failing to conform to Contract Documents. Replace or re- execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in the opinion of the Department Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by the Department Representative.

1.7 REPORTS

.1 Submit 4 copies of inspection and test reports to the Department Representative.

.2 Provide copies to Subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.8 TESTS AND MIX DESIGNS

.1 Furnish mix results and test designs as may be requested.

.2 The costs of test and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by the Department Representative and may be authorized as recoverable.

1.9 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all sections required to provide mock-ups.

.2 Construct in all locations acceptable to the Department Representative.

.3 Prepare mock-ups for the Department Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, the Department Representative will assist in preparing a schedule fixing dates for preparation.

.6 Remove mock-up at conclusion of Work or when acceptable to.

.7 Mock-ups may remain as part of Work.

.8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.10 MILL TESTS

.1 Submit mill test certificates as requested or required of specification Sections.

1.11 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.4 WATER SUPPLY

.1 Existing sources of water will not be made available to the Contractor. Arrange for connection and pay all costs for installation, maintenance and removal of water supply. Conversions or alterations to existing sources of water to meet construction requirements are the responsibility of the Contractor.

.2 The points of delivery and limits on amount available will be determined on site by the Department Representative whose written permission must be obtained before any connection is made.

1.5 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted, unless prior approval is given by the Department Representative.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10°C in areas where construction is in progress.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building may not be used when available, unless there are savings to the contract price and the Department Representative's written permission is obtained stating conditions of use, provisions relating to guarantees on equipment and operation and maintenance of system. Be responsible for damage to heating systems if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters.

.8 Ensure date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by the Department Representative.

.9 Pay costs for maintaining temporary heat, when using permanent heating system. The Department Representative will pay utility charges when temporary heat source is existing building equipment.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside,

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6 TEMPORARY POWER AND LIGHT

.1 Existing sources of electric power will not be made available to the Contractor. Conversions or alterations to existing sources of electric power to meet construction requirements are the responsibility of the Contractor.

.2 The points of delivery and limits on amount available will be determined on site by the Department Representative whose written permission must be obtained before any connection is made.

.3 The Contractor will be responsible for the installation of Service Entrance equipment including the meter base.

.4 Electrical power and lighting systems under this Contract may be used for construction requirements only with prior approval of the Department Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.7 TEMPORARY COMMUNICATION FACILITIES

.1 Contractor shall provide and pay for temporary telephone, fax, data hook-up, lines and equipment necessary for own use.

1.8 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

2 Products

Not Used

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 including dewatering 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.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-Z321 Signs and Symbols for the Occupational Environment

1.3 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 SCAFFOLDING

.1 Provide scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.

1.5 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists and cranes shall be operated by qualified operator.

1.6 SHORING AND BRACING

.1 Contractor is responsible for the design, supply, installation and maintenance of any shoring, bracing or similar type systems required during the execution of the Work. Coordinate use with the Department Representative.

.2 Provide certification of any such shoring, bracing or similar type systems as directed by the Department Representative or as required by the Ministry of Labour, Ontario.

1.7 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.8 CONSTRUCTION PARKING/MOBILE OFFICE TRAILER

.1 Parking will be permitted on site provided it does not disrupt performance of Work or public access.

.2 Provide and maintain adequate access to project site.

.3 Build or maintain temporary roads where indicated or directed by the Department Representative and provide snow removal during period of Work as deemed necessary.

.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor’s use of roads.

.5 Contractor to provide a construction trailer to conduct meetings with staff, consultants, Parks Canada staff etc.. Furnish in the trailer a full size complete set of drawings, specifications, approved materials and mock ups if they can be accommodated in the trailer.

1.9 FIRST AID

.1 Provide a clearly marked and fully stocked first-aid case in a readily available location.

1.10 EQUIPMENT, TOOL AND MATERIAL STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.11 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area clean and premises in sanitary condition.

.3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of the Department Representative.

1.12 CONSTRUCTION SIGNAGE

.1 Direct requests for approval to erect a Contractor signboard to the Department Representative.

.2 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN3-Z321.

.3 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by the Department Representative.

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control: adequate to ensure safe operation at all times.

.11 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.

.12 Provide snow removal during period of Work.

1.14 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This Specification includes the general description of the “TRAFFIC CONTROL” and the requirements of that plan. This specification applies to the furnishing of all labor, equipment, and materials and in performing all operations in connection with the “TRAFFIC CONTROL” in accordance with the plans and these specifications.

1.2 SUBMITTALS

.1 The Contractor shall submit a “Traffic Control Plan” prior to commencing construction. All plans must be in accordance with the latest version of the Ministry of Transportation’s Book 7: Ontario Traffic Manual – Temporary Conditions. No plan may be implemented until approved by the Department Representative.

.2 The Contractor shall submit an updated “Traffic Control Plan” upon request of the Department Representative.

2 Products

Not Used

3 Execution

3.1 CONSTRUCTION METHODS

.1 The “Traffic Control Plan” and the installation of all devices shall be continuously reviewed and updated to reflect the current stage of construction. The inspector may review minor changes; the Department Representative shall review major changes. The construction foreman shall provide the current “Traffic Control Plan” to the inspector upon request on the site at any time during the construction of the project.

.2 The Contractor shall provide a minimum of 24 hours notification for any lane closures on Cyprus Lake Road.

.3 The Traffic Controls shall be implemented in conformance to the Ministry of Transportation’s Book 7: Ontario Traffic Manual – Temporary Condition. The Contractor shall provide a minimum of two (2) flagmen to direct vehicles for all lane closures.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosure using new 1.2m high snow fence wired to rolled steel “T” bar fence posts spaced at 2.4m oc. Provide one lockable truck gate. Maintain fence in good repair. Requirement may be eliminated with the direction of the Department Representative subject to site conditions.

.2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

.1 Provide weather tight enclosures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.6 DUST TIGHT SCREENS

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

.2 The Contractor is responsible for snow removal to access the site through the winter.

1.8 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights or lanterns as required to perform Work and protect the public. Maintain pedestrian access on the existing gravel trail running parallel to Cyprus Lake Road and crossing at the entrance to the proposed Hub Amenity Building site.

1.9 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, coverings and hoardings.

.3 Confirm with the Department Representative locations and installation. Schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 QUALITY

.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality, (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products**,** decision rests strictly with the Department Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify the Department Representative of such, in order that substitution or other remedial action may be authorized in ample time to prevent delay on performance of Work

.2 In event of failure to notify the Department Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Department Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Handle and restore products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer`s instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer`s seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of the Department Representative.

.9 Touch-up damaged factory finished surfaces to the Department Representative`s satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation costs of products supplied by Owner will be paid for by the Department Representative. Unload, handle and store such products.

1.6 MANUFACTURERS INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer`s instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions daily from manufacturers.

.2 Notify the Department Representative in writing, of conflicts between specifications and manufacturer's instructions, so that the Department Representative may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Department Representative to require removal and re- installation at no increase in Contract Price or Contract Time.

1.7 QUALITY OF WORK

.1 Ensure quality of work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify the Department Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. The Department Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with the Department Representative, whose decision is final.

1.8 COORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Department Representative if there is interference. Install as directed by the Department Representative.

1.10 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform the Department Representative of conflicting installation. Install as directed.

1.12 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagonal heads, semi-finished unless otherwise specified. Use No. 316 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts,

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 PROTECTION OF WORK IN PROGRESS

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, as directed by Department Representative, at no increase in Contract Price or Contract Time.

.2 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of the Department Representative.

1.15 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Requirements and limitations for cutting and patching the Work.

1.2 SUBMITTALS

.1 Submit written request and obtain the Department Representative's approval in advance of cutting or alteration which affects:

.1 Structural integrity of any element of Project.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which may be exposed by uncovering work. Maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Fit Work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling or floor construction, completely seal voids with "ULC approved" firestopping material, full thickness of the construction element.

.12 Refinish surfaces to match adjacent finishes: for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final Cleaning.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Department Representative. Do not burn waste materials on site.

.3 Clear snow and ice from access to building, bank/pile up snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use clearly marked separate bins for recycling.

.7 Remove debris daily to a designated Landfill Site. The work site must be left clean and tidy upon completion, to the satisfaction of the Department Representative.

.8 Contractors shall adhere to landfill site restrictions and specified dumping areas.

.9 All materials shall be separated into the following categories:

.1 Clean wood products (ie. branches, logs, etc.).

.2 Dirty wood products (ie. building lumber with nails, metal, etc. attached).

.3 Concrete (max size 600mm x 600mm).

.4 Domestic garbage.

.5 Cardboard.

.6 Leaves, grass clippings etc.

.7 Asbestos materials.

.8 Metal products.

.10 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.

.11 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.12 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation system is not permitted for this purpose.

.13 Use only cleaning materials recommended by manufacture of surface to be cleaned, and as recommended by cleaning material manufacturer.

.14 Schedule cleaning operation so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 FINAL CLEANING

.1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.

.4 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.5 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.

.6 Clean lighting reflectors, lenses and other lighting surfaces.

.7 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.8 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.10 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.11 Remove dirt and other disfiguration from exterior surfaces.

.12 Clean and sweep roofs, gutters, areaways and sunken wells.

.13 Sweep and wash clean paved areas.

.14 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.15 Clean roofs, downspouts and drainage systems.

.16 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.17 Remove snow and ice from access to building.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meetings with Departmental Representative to review and discuss Waste Management Goals.

.2 Waste Management Goal is 75 percent of total project waste to be diverted from landfill sites. Provide Departmental Representative documentation that waste management, recycling, reuse of recyclable and reusable materials have been extensively practised.

.3 Accomplish maximum control of solid construction waste.

.4 Preserve environment and prevent pollution and environment damage.

1.2 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures

.2 Section 01 74 00 Cleaning and Waste Management

1.3 DEFINITIONS

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Demolition Waste Audit (DWA): relates to actual waste generated from project.

.4 Inert Fill: inert waste- exclusively asphalt and concrete.

.5 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.11 Separate Condition: refers to waste sorted into individual types

.12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

.14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WR W is based on information acquired from W A (Schedule A).

1.4 DOCUMENTS

.1 Maintain at job site, one copy of following documents:

.1 Material Source Separation Plan (MSSP).

1.5 SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:

.1 Submit 2 copies of Materials Source Separation Program (MSSP) description

.3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project.

.1 Failure to submit could result in holdback of final payment.

.2 Provide receipts, scale tickets and waybills and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.

.3 For each material reused, sold or recycled from project, include amount in tonnes and the destination.

.4 For each material landfilled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.6 WASTE AUDIT (W A)

.1 W A is not applicable for this project.

1.7 WASTE REDUCTION WORKPLAN (WRW)

.1 WRW is not applicable for this project.

1.8 DEMOLITION WASTE AUDIT (DWA)

.1 Prepare and submit a demolition waste audit 2 weeks before any work on site.

.2 DWA to include an inventory of materials and quantities to be salvaged for reuse, recycling or disposal.

1.9 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 CRAW is not applicable for this project.

1.10 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas which minimize material damage .

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate Condition.

.1 Transport to approved and authorized recycling facility and to users of material for recycling.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.

.1 Ship materials to site operating under Certificate of Approval.

.2 Materials must be immediately separated into required categories for reuse or recycling.

1.11 WASTE PROCESSING SITES

.1 Name: St. Edmunds Landfill, Municipality of Northern Bruce Peninsula.

.1 Contact Name: Troy Cameron.

.2 Telephone: 519-793-3522 ext. 232

.3 Fax: 519-793-3823

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect structural components not removed for demolition from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

.7 Protect surface drainage from damage and blockage.

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.

.2 Remove co-mingled materials to off-site processing facility for separation.

.3 Provide waybills for separated materials.

.9 Protective masks / respirators and gloves should be worn when handling asbestos and mould as per Regulation 278/05.

1.13 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

.1 Number and size of bins.

.2 Waste type of each bin.

.3 Total tonnage generated.

.4 Tonnage reused or recycled.

.5 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/disassembly work progresses.

.5 Disposal of asbestos shall conform to Ontario Regulation 278/05.

1.14 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

1.15 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

2 Products

Not Used

3 Execution

3.1 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

.1 Separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

.2 On-site sale of salvaged, recovered, reusable or recyclable materials is not permitted.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 As-built, samples and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.2 SUBMISSION

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

.2 At least 2 weeks prior to scheduled commissioning activities, submit 2 copies of the DRAFT operating and Maintenance Manuals, for the Department Representative's review and use during the commissioning activities. After the completion of the commissioning activities, the Department Representative will return to the Contractor 1 DRAFT copy, with review comments, for revision. Submit 1 copy of the revised Operating and Maintenance Manual for approval prior to the production of FINAL copies. Prior to the issuance of the Final Certificate of Completion, and within 10 working days after the issuance of the Interim Certificate of Completion, submit 2 copies of the FINAL Operating and Maintenance Manuals.

.3 Building will not be deemed ready for use unless the draft copies of the Operating and Maintenance Manuals and the "As-built" Record Documents have been submitted and reviewed by the Department Representative.

.4 Building will not be deemed ready for use unless the completed and submitted Operating and Maintenance Manuals and "As-built" Record Documents have been accepted by the Department Representative.

.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 If requested, furnish evidence as to 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.

1.3 FORMAT

.1 Organize data in the form of an instruction 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 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.

1.4 CONTENTS – EACH VOLUME

.1 Table of Contents: provide title of project:

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Contractor with name of responsible parties.

.3 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 clearly identify specific products and component parts of equipment and systems, to show control and flow diagrams.

.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 specified in Section 01 45 00 – Quality Control.

.6 Training: Refer to Section 01 79 00 – Demonstration and Training.

1.5 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for the Department Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data and samples.

.6 Field Test Records.

.7 Inspection certificates.

.8 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 the Department Representative.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of opaque drawings provided by the Department Representative.

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

.3 Contract drawings and shop drawings: legibly 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.

.4 Submit following drawings:

.1 Record changes in red. Mark on one set of prints and at completion of project prior to final inspection, neatly transfer as-built records to second set of white prints using fine red marker. Neatly print lettering and numbers in size to match original. Lines may be drawn free-hand but shall be neat and accurate. Annotate “AS-BUILT RECORD” in each drawing title block. Also, circle on List of Drawings each title and number of drawings marked with as-built records.

.2 At least 2 weeks prior to scheduled commission activities, submit one copy of the DRAFT “As-built” Project Record Documents for the Department Representative’s review and use during the commission activities. After the completion of the commissioning activities, the Department Representative will return to the Contractor the DRAFT copy, with review comments, for revision. Prior to the issuance of the Final Certificate of Completion, and within 10 working days after the issuance of the Interim Certificate of Completion, submit 2 copies of the FINAL “As-built” Project Record Documents.

.5 Specifications: legibly 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.

1.7 FINAL SURVEY

.1 Final site survey certificate is not required for this project.

1.8 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with the Department Representative’s 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 Include installed colour coded wiring diagrams.

.4 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.

.5 Maintenance requirements: include routine procedures and guide for troubleshooting; disassembly, repair and reassembly instructions; and alignment, adjustment, balancing and checking instructions.

.6 Provide servicing and lubrication schedule.

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

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

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

.14 Include test and balancing reports as specified in Section 01 45 00 – Quality Control.

.15 Additional requirements: As specified in individual specification sections.

1.9 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.

1.10 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 Spare parts as identified in individual sections are to be delivered to the Department Representative prior to the Contractor`s submission for Interim Certificate of Completion.

.4 Receive and catalogue all items. Submit inventory listing to the Department Representative. Include approved listings in Maintenance Manual.

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

1.11 MAINTENANCE MATERIALS

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

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

.3 Maintenance materials are to be delivered to the Department Representative prior to the Contractor`s submission for Interim Certificate of Completion.

.4 Receive and catalogue all items. Submit inventory listing to the Department

.5 Representative. Include approved listings in Maintenance Manual. Obtain receipt for delivered products and submit prior to final payment.

1.12 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 Special tools are to be delivered to the Department Representative prior to the Contractor's submission for Interim Certificate of Completion.

.4 Receive and catalogue all items. Submit inventory listing to the Department Representative. Include approved listings in Maintenance Manual.

1.13 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 the Department Representative.

1.14 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier and manufacturer with name, address and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers and manufacturers within ten days after completion of the applicable item of work.

.4 Except for items put into use with Department Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined. Verify that documents are in proper form, contain full information and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

1.15 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Consultant.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of equipment and systems to Department Representative.

1.2 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to Department Representative two weeks prior to date of final inspection.

.2 Department Representative will provide list of personnel to receive instruction, and will coordinate their attendance at agreed upon time.

1.3 QUALITY CONTROL

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Department Representative and provide written report that demonstration and instruction have been completed.

1.4 SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for the Department Representative's approval.

.2 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.

1.5 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

.2 Testing, adjusting and balancing has been performed in accordance with Section 01 45 00 – Quality Control and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.6 PREPARATION

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

.2 Verify that designated personnel are present.

1.7 DEMONSTRATION AND INSTRUCTIONS

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

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

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

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

1.8 TIME ALLOCATED FOR INSTRUCTIONS

.1 Ensure amount of time required for instruction of each item of equipment or system as follows:

.1 **Heating, Cooling and Ventilation System**: 1 hour of instruction.

.2 **Control System**: 1 hour of instruction.

.3 **Plumbing/Holding Tank**: 1 hour of instruction.

.1 Bio filter waste water system: 8 hours of instruction

.4 **Electrical System**: 2 hours of instruction.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.9 Section 03 20 00 – Concrete Reinforcing

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

.11 Section 03 35 00 – Concrete Finishing

.12 Section 03 35 33 – Stamped Concrete Finishing

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-09, 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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings for formwork and falsework.

.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 CAN/CSA-S269.3 for formwork drawings.

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

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.

.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 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.

.1 Spiral pattern not to show in hardened concrete.

.3 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.

.4 Form liner:

.1 High density overlay Douglas Fir.

.5 Form release agent: non-toxic.

.6 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 15 to 24 mm2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

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

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

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

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

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

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

.6 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.

.7 Align form joints and make watertight.

.1 Keep form joints to minimum.

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

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

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

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

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

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

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

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

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.9 Section 03 10 00 – Concrete Forming and Accessories

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

.11 Section 03 35 00 – Concrete Finishing

1.2 REFERENCE STANDARDS

.1 American Concrete Institute (ACI)

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

.2 ASTM International

.1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.3 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.4 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 CSA International

.1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.

.3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

.4 CSA-G40.20/G40.21-04(R2009), 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.

.6 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Shop Drawings:

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

.1 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

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

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

1.4 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 45 00- Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.1 Mill Test Report: upon request, provide Parks Canada Representative and Consultant with certified copy of mill test report of reinforcing steel.

.2 Upon request submit in writing to Parks Canada Representative and Consultant proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations.

.2 Replace defective or damaged materials with new.

2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Parks Canada Representative and Consultant.

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

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

.4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

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

.1 Provide in flat sheets only.

.6 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.

.7 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610g/m^2.

.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.

.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.

.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.

.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.

.1 In this case, no restriction applies to temperature of solution.

.4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.

.1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

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

.9 Mechanical splices: subject to approval of Parks Canada Representative and Consultant.

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

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.1 SP-66 unless indicated otherwise.

.2 Obtain Parks Canada Representative and Consultant written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Parks Canada Representative and Consultant, weld reinforcement in accordance with CSA W186.

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

.1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Parks Canada Representative and Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request inform Parks Canada Representative and Consultant of proposed source of material to be supplied.

3 Execution

3.1 PREPARATION

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment to be 1 hour per 25 mm of bar diameter.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Parks Canada Representative and Consultant.

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

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel in accordance with CSA-A23.1/A23.2.

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

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

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

.3 Prior to placing concrete, obtain Parks Canada Representative and Consultant's approval of reinforcing material and placement.

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

3.4 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00- Cleaning and Waste Management.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00- Cleaning and Waste Management.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.9 Section 03 10 00 – Concrete Forming and Accessories

.10 Section 03 20 00 – Concrete Reinforcing

.11 Section 03 35 00 – Concrete Finishing

.12 Section 03 35 33 – Stamped Concrete Finishing

1.2 REFERENCES

.1 Abbreviations and Acronyms:

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.

.1 Type GU, GUb and GUL - General use cement.

.2 Type MS and MSb - Moderate sulphate-resistant cement.

.3 Type MH, MHb and MHL - Moderate heat of hydration cement.

.4 Type HE, HEb and HEL - High early-strength cement.

.5 Type LH, LHb and LHL - Low heat of hydration cement.

.6 Type HS and HSb - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with CaO content less than 15%.

.2 Type CI - with CaO content ranging from 15 to 20%.

.3 Type CH - with CaO greater than 20%.

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

.2 Reference Standards:

.1 ASTM International

.1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-10a, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.6 ASTM D624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.7 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.8 ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 CSA International

.1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Concrete pours: provide 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.

.3 Concrete hauling time: provide for review by Parks Canada Representative and Consultant, deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

.4 Provide two copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Provide Parks Canada Representative and Consultant, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Consultant on following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative, Consultant and laboratory representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative and Consultant.

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

.2 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 DESIGN CRITERIA

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

2.2 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and Consultant and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

.1 Portland Cement: to CSA A3001, Type GU.

.1 Reduction in cement from Base Mix to Actual Supplementary Cementing Materials (SCMs) Mix, as percentage.

.2 Blended hydraulic cement: Type GUb to CSA A3001.

.3 Portland-limestone cement: Type GUL to CSA A23.1.

.4 Supplementary cementing materials: with minimum 20% N, by mass of total cementitious materials to CSA A3001.

.5 Water: to CSA A23.1.

.6 Aggregates: to CSA A23.1/A23.2.

.7 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 ASTM C1017. Parks Canada Departmental Representative and Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.

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

.1 Compressive strength: 35 MPa at 28 days.

.9 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand.

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

.11 Mechanical waterstops: ribbed extruded PVC, of sizes indicated with prewelded corner and intersecting pieces with legs not less than 150 mm long:

.1 Elongation: to ASTM D412, method A, Die "C", minimum 250%.

.2 Tear resistance: to ASTM D624, method A, Die "B", minimum 30 kN/m.

.12 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

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

.3 Standard cork: to ASTM D1752, Type II.

.13 Weep hole tubes: galvanized steel.

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

.15 Polyethylene film: 6 mil thickness to CAN/CGSB-51.34.

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative and Consultant performance criteria to CSA A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

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

.1 Workability: free of surface blemishes.

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

.1 Lean Concrete, Mud Slab: 10 MPa, Class N

.2 Footings: 20 MPa, Class N

.3 Foundation Walls, Piers, Concrete Walls: 25 MPa, Class F-2

.4 Interior Slab-on-Grade and Concrete on steel deck: 25 MPa, Class N

.5 Exterior Concrete Slab-on-Grade: 32 MPa, Class C-2

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

.5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

3 Execution

3.1 PREPARATION

.1 Obtain Parks Canada Departmental Representative and Consultant's written approval before placing concrete.

.1 Provide 24 hours minimum notice prior to placing of concrete.

.2 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.

.3 Pumping of concrete is permitted only after approval of equipment and mix.

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

.5 Prior to placing of concrete obtain Parks Canada Departmental Representative and Consultant's 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 shrinkage compensating grout to anchor and hold dowels in positions as indicated.

.10 Do not place load upon new concrete until authorized by Parks Canada Departmental Representative and Consultant.

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work to 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 Parks Canada Departmental Representative and Consultant.

.2 Where approved by Parks Canada Departmental Representative and Consultant, 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 Parks Canada Departmental Representative and Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Parks Canada Departmental Representative and Consultant before placing of concrete.

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

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

.3 Anchor bolts:

.1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.

.2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Parks Canada Departmental Representative and Consultant.

.1 Formed holes: 100 mm minimum diameter.

.2 Drilled holes: to manufacturers' recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with shrinkage compensating grout epoxy grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Install weep hole tubes and drains as indicated.

.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 to CSA A23.1/A23.2.

.2 Use procedures as reviewed by Parks Canada Departmental Representative and Consultant, or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.3 Use curing compounds compatible with applied finish on concrete surfaces.

.4 Provide screed finish where floor tile is to be applied.

.5 Provide float finish unless otherwise indicated.

.6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum 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.

.3 Do not displace reinforcement when installing waterstops.

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

.5 Tie waterstops rigidly in place.

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

.7 Use factory welded corners and intersections unless otherwise approved by Parks Canada Departmental Representative and Consultant.

.8 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Parks Canada Representative and Consultant.

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

.3 Locate and form isolation and 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.

.9 Dampproof membrane:

.1 Install dampproof membrane under concrete slabs-on-grade inside building.

.2 Lap dampproof membrane minimum 150 mm at joints and seal.

.3 Seal punctures in dampproof membrane before placing concrete.

.4 Use patching material at least 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1 Straightedge Method FF = 3.

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 7 and 56 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Parks Canada Departmental Representative and and Consultant for review to CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified to CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Parks Canada Representative and Consultant.

.4 Departmental Representative will pay for costs of tests.

.5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

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

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.9 Section 03 10 00 – Concrete Forming and Accessories

.10 Section 03 20 00 – Concrete Reinforcing

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

.12 Section 03 35 33 – Stamped Concrete Finishing

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20-95, Surface Sealer for Floors.

.2 CSA International

.1 CAN/CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Provide two copies of WHMIS MSDS. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.

.2 Include application instructions for concrete floor treatments.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Temporary lighting:

.1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.

.2 Electrical power:

.1 Provide sufficient electrical power to operate equipment normally used during construction.

.3 Work area:

.1 Make work area water tight protected against rain and detrimental weather conditions.

.4 Temperature:

.1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.

.5 Moisture:

.1 Ensure concrete substrate is within moisture limits prescribed by manufacturer.

.6 Safety:

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Ventilate enclosed spaces in accordance with Section 01 51 00- Temporary Utilities.

.2 Provide continuous ventilation during and after coating application.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

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

2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Section 01 61 00- Common Product Requirements.

.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

2.2 CHEMICAL HARDENERS

.1 Type 1 - Sodium silicate.

.2 Water: potable.

2.3 SEALING COMPOUNDS

.1 Surface sealer: to CAN/CGSB-25.20, Type 2 - water based, clear.

2.4 CURING COMPOUNDS

.1 Select water-based curing compounds.

2.5 CONCRETE STAINS

.1 Select water-based concrete stains.

2.6 MIXES

.1 Mixing ratios in accordance with manufacturer's written instructions.

3 Execution

3.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work and elevations are as indicated on drawings.

3.2 PREPARATION OF EXISTING SLAB

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

.2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.

3.3 APPLICATION

.1 Apply concrete finishing floor hardener in accordance with manufacturer's written instructions.

.2 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.

.3 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.4 Clean over spray. Clean sealant from adjacent surfaces.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

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

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

3.5 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Stamped concrete finishing.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

.1 ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.2 ASTM C979 - Standard Specification for Pigments for Integrally Coloured Concrete.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods.

.3 Selection Samples: For each finish product specified, two complete sets of colour chips representing manufacturer's full range of available colours and patterns.

.4 Verification Samples: For each finish product specified, two samples, minimum size 305 mm (12”) square representing actual product, colour, and patterns.

.5 Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

.6 Applicator's Project References: Submit applicator's list of successfully completed stamped concrete projects, including project name and location, name of Consultant, and type and quantity of materials applied.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Minimum five (5) year experience manufacturing similar products.

.2 Installer Qualifications: Minimum two (2) year experience installing similar products.

.1 Regularly engaged, for preceding five (5) years, in application of stamped concrete of similar type to that specified.

.2 Employ persons trained for application of stamped concrete.

.3 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

.1 Construct Mock-ups of Stamped Concrete:

.1 Use same materials and methods for use in the Work.

.2 Location: Determined by Consultant.

.3 Minimum Size: 1219 mm by 1219 mm, (4 feet by 4 feet).

.2 Receive approval of mock-ups by Consultant for patterns, colours, textures, finishing, curing, cleaning, sealing, special effects, and workmanship before application of stamped concrete.

.3 Approved Mock-ups:

.1 Standard for patterns, colours, textures, finishing, curing, sealing, special effects, and workmanship of stamped concrete.

.2 Retain through completion of Work for use as quality standard.

1.6 PRE-INSTALLATION MEETINGS

.1 Convene minimum two (2) weeks prior to starting work of this Section.

.1 Require attendance of parties directly affecting work of this section, including:

.1 Contractor.

.2 Landscape Architect.

.3 Applicator.

.4 Manufacturer's representative.

.5 Departmental Representative

.2 Review:

.1 Mock-ups.

.2 Materials.

.3 Preparation.

.4 Application.

.5 Finishing.

.6 Curing.

.7 Cleaning.

.8 Sealing.

.9 Protection.

.10 Coordination with other work.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

.2 Storage and Handling Requirements:

.1 Store and handle materials in accordance with manufacturer's instructions.

.2 Keep materials in manufacturer's original, unopened containers and packaging until application.

.3 Store materials in clean, dry area indoors.

.4 Store materials out of direct sunlight.

.5 Keep materials from freezing.

.6 Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

.2 Apply materials when air and surface temperatures are between 13 deg C (55 degrees F) and 27 deg C, (80 deg F).

.3 Do not apply materials when rain, snow, or excessive moisture is expected during application or within 24 hours after application.

1.9 SEQUENCING

.1 Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturer: Brickform, 11061 Jersey Boulevard, Rancho Cucamonga, California 91730. Toll Free 800-483-9628. Phone 909-484-3399. Fax 909-484-3318. Website www.brickform.com.

.2 Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS

.1 Day 1 Finishing:

.2 Dry Integral Concrete Colour: BRICKFORM "Powdered Colour".

.1 Compliance: ASTM C979.

.2 Colour: Shadow Grey or approved equivalent.

.3 Antique Release:

.1 Product ID:RA by BRICKFORM or approved equivalent.

.1 Colour: 100-Dark Grey.

.4 Colourless Bond Breaker.

.1 Colourless Bond Breaker: BRICKFORM"Liquid Release".

.5 Seamless Skins: BRICKFORM Seamless Skins™ are feathered-edged skins that produce continuous texture with no grout or joint lines.

.1 Model Number: FM-C.

.2 Pattern: Rough Stone Texture characterized by a continuous coarse surface with several distinguishing veins.

.6 Curing Compound:

.1 Clear, non-yellowing, non-staining, breathable, UV stable.

.2 Compliance: ASTM C309.

.3 Compatible with coloured concrete.

.7 Concrete Cleaner: BRICKFORM "Antique Release/Efflorescence Remover".

.1 Biodegradable.

.8 Sealer: Low-Sheen Sealer with Traction Grip: BRICKFORM "Safety-Seal".

.1 Slip-resistant, UV-resistant, lacquer-based, acrylic, clear sealer.

3 Execution

3.1 EXAMINATION

.1 Examine surfaces to receive stamped concrete.

.2 Notify Architect of conditions that would adversely affect application or subsequent use.

.3 Do not begin preparation or application until unacceptable conditions are corrected.

3.2 PREPARATION

.1 Protection of In-Place Conditions: Protect adjacent surfaces, areas, adjoining walls, and landscaping from contact with stamped concrete materials.

.2 Preparation of Subgrade:

.1 Ensure subgrade is uniformly graded, compacted, and moistened.

.2 Ensure subgrade is free of standing water.

.3 Do not place concrete over soft, frozen, or muddy subgrade.

.3 Concrete:

.1 Specified in Section 03 30 00 - Cast-in-Place Concrete, unless otherwise specified in this section.

.2 Cement Content: Minimum 8 sacks per cubic meter.

.3 Slump: Maximum 100 mm.

.4 Calcium Chloride: Do not use calcium chloride or admixtures containing calcium chloride.

.5 Fine and Course Aggregates:

.1 Non-reactive.

.2 Free of deleterious material.

3.3 APPLICATION

.1 Apply stamped concrete materials in accordance with manufacturer's instructions at locations indicated on the Drawings.

.2 Integrally Coloured Concrete: Design mix, batch, add colourant, place, finish, and cure concrete in accordance with integral concrete colour manufacturer's instructions.

.3 Colourless Bond Breaker:

.1 Apply colourless bond breaker in accordance with manufacturer's instructions to bottom of stamping mats and on concrete surface, when concrete has reached plastic stage desirable for imprinting.

.2 Do not trowel or mix colourless bond breaker into plastic concrete surface.

.4 Seamless Skins:

.1 Utilize seamless skins in accordance with manufacturer's instructions into concrete that has reached plastic stage desirable for imprinting.

.2 Use seamless skins to create patterns in concrete as indicated on the Drawings.

.5 Approved Mock-ups: Match approved mock-ups for patterns, colours, textures, finishing, curing, cleaning, sealing, special effects, and workmanship.

3.4 CURING

.1 Cure concrete in accordance with manufacturer's instructions.

.2 Apply curing compound in accordance with manufacturer's instructions.

.3 Do not cure concrete using materials or methods harmful to concrete surface, including:

.1 Low-pressure or high-pressure steam.

.2 Burlap.

.3 Plastic sheeting.

.4 Membrane paper.

.5 Water misting.

.6 Sodium-silicone-type hardeners.

3.5 CLEANING

.1 Clean concrete in accordance with manufacturer's instructions.

.2 Apply concrete cleaner in accordance with manufacturer's instructions to remove:

.1 Excess coloured bond breaker/antiquing release agent.

.2 Efflorescence.

.3 Cement scale.

.3 Apply concrete cleaner before sealing concrete surface.

3.6 SEALING

.1 Seal concrete surfaces in accordance with manufacturer's instructions.

.2 Apply sealer to clean and dry concrete surfaces in accordance with manufacturer's instructions after concrete has cured a minimum of 28 days.

.3 Apply sealer uniformly over entire stamped concrete surface.

.4 Do not allow traffic on finished sealed surfaces for the following periods after application:

.1 Foot Traffic: Minimum 24 hours.

.2 Heavy Traffic: Minimum 72 hours.

3.7 PROTECTION

.1 Exterior Surfaces: Protect applied stamped concrete to ensure that, except for normal weathering, concrete will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section includes supply and installation of unit masonry and dimensional stone veneer cladding coordinate with structural general notes and drawings

.2 assemblies consisting of the following:

.1 Concrete Masonry Units (CMUs)

.2 Fire Rated Concrete Masonry Units (CMUs)

.3 Dimensional Stone Veneer Cladding

.4 Mortar, and Grout

.5 Reinforcing steel

.6 Masonry joint reinforcement

.7 Ties and anchors

.8 Embedded flashing

.9 Miscellaneous masonry accessories

1.2 RELATED REQUIREMENTS

.1 General Requirements shall apply.

.2 Review and comply with N.B.C. Section 9.20. Above Grade Masonry, and CAN3- S304 Masonry Design for Buildings. These material and performance standards shall apply as if repeated here.

.3 Related Work:

.1 Coordinate with structural general notes & drawings

.2 Section 05 50 00 - Metal Fabrications

.3 Section 07 26 00 - Vapour Retarders (Air Barriers)

.4 Section 07 21 13 - Board Insulation

.5 Section 07 62 00 - Sheet Metal, Flashing and Trim

.6 Section 07 84 00 - Fire Stopping and Smoke Seals

.7 Section 07 92 00 - Joint Sealants

.8 Section 08 11 00 - Metal Door and Frames

.9 Section 08 51 13 - Windows (Aluminum)

.10 Section 09 90 00 - Painting

.4 Tolerances:

.1 Planes within 3mm perm under straight edge

.2 Plumb within 6mm in 3m, or in 6m at external corners

.3 Level within 6mm in 6m

.4 Joints as indicated but in no case greater than 12mm

.5 Store and handle masonry units to protect from ground contact and other materials until laid to prevent staining Cover masonry unit stock piles, to prevent exposure to weather.

.7 References:

.1 CAN/CSA A165 SERIES, CSA Standards on Concrete Masonry Units, covers: A165.1, A165.2, A165.3.

.2 CAN/CSA A371, Masonry Construction for Buildings.

.3 CSA S304.1, Design of Masonry Structures.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04050 – Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheet. Indicate VOC's for joint fillers and sealants.

.2 Manufacturer's Instructions:

.1 Provide manufacturer's installation instructions.

.3 Shop Drawings:

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

.2 Indicate sizes and sections of stone, arrangements of joints and bonding, anchoring, dowelling and cramping.

.4 Samples:

.1 Provide 2 samples of all unit masonry & Dimensional Stone Veneer Cladding

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data:

.1 Provide maintenance data for incorporation into manual specified in Division 1.

1.6 QUALITY ASSURANCE

.1 Quality Control

.1 Obtain stone from single quarry source with resources to provide materials of specified consistent quality.

.2 Obtain mortar ingredients of uniform quality and from a single manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

.3 Obtain each type of stone accessory, sealants and other materials from a single manufacturer for each product.

.2 Mock-ups:

.1 Construct mock-ups in accordance with Section 01450 – Quality Control and to requirement of Section 04050 – Common Work Results for Masonry , supplemented as follows:

.2 Erect an independent sample of exterior masonry, showing finished colour of unit and mortar, type of unit, joint, coursing, 2 m x 1 m, complete with all accessories. Mock-up to include corner condition and sill. Obtain Department Representative’s approval. This sample is to remain intact until work of this Section is complete. Perform test cleaning on mock-up to ensure desired result as per article 3.14 Cleaning.

1.7 SITE CONDITIONS

.1 Ambient Conditions:

.1 Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

.2 Field Measurements:

.1 Make field measurements necessary to ensure the proper fit of all members.

2 Products

2.1 DIMENSION CULTURED STONE VENEER CLADDING

.1 Manufacturers

.1 Shouldice or approved equal. Stone to match Campground Reception Building located in the Cyprus Lake Campground, Tobermory Ontario.

.2 Design Criteria

.1 General: design, fabricate and install stonework to withstand normal loads from wind, gravity, movement of building structure, seismic forces and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.

.2 Retain services of cladding engineer, as described below, to design the cladding support and retention system. Cladding engineer will prepare engineering calculations for justification of principal stonework, units, fasteners, and anchorage components for compliance with performance criteria.

.3 Engineering Calculations: base calculations on design loads, material properties, and applicable safety factors, in compliance with applicable codes and Building Standards. Include following information as part of calculations:

.1 Stone loads and allowable loads,

.2 Stone thicknesses,

.3 Support and anchorage loads, stresses, safety factors, design loads, and allowable loads, Support and anchorage sizes.

.4 Design connections and attachments for limestone to CAN/CSA A370.

.5 Design, detail and fabricate connections to provide allowance for fabrication tolerances, erection tolerances and structural deflections. Refer to CAN/CSA A370 and CAN/CSA A371 ASTM C 1242.

.6 Control of Corrosion: prevent galvanic and other forms of corrosion by insulating metals and other materials from direct contact with non-compatible materials, or by suitable coating.

.3 Stone Materials

.1 Stone material to match installed stone on the Cyprus Lake Campground Reception Building. Final stone material to be approved by AECOM and Parks Canada.

.4 Fabrication

.1 Cut stone to shape and dimensions and full to square with joints as indicated.

.2 Dress exposed faces true.

.3 Cut stone for sills and lintels to lay on its natural quarry bed.

.4 Execute profiled work from full size details and templates.

.5 Make exposed arises in true alignment and ease slightly to prevent snipping.

.6 Back-check stone contacting structural members as indicated.

.7 Allow minimum of 25 mm clearance between back of stone and concrete block.

.8 Shape beds of stone resting on structural work to fit supports.

.9 Cut stones for anchors, cramps, dowels and support systems.

.10 Provide Lewis pin and clamp holes in pieces which cannot be manually lifted.

.11 Do not cut holes in exposed surfaces.

.12 Finish exposed faces and edges of stones to comply with requirements indicated for finish and to match approved samples and field-constructed mock-up.

2.2 THROUGH WALL FLASHING

.1 Flexible Flashing: Blueskin reinforced membrane through-wall flashing.

.2 Sheet Metal: Prefinished.

2.3 BACK PRIMING FOR FLASHING

.1 Bituminous paint, alkali resisting, CGSB1-GP-1 08.

2.4 LAP CEMENT

.1 CGSB 37-GP-4 Tremco Acoustical Sealant.

2.5 JOINT REINFORCEMENT

.1 Standard weight by Blok-Lok Limited, galv. Finish to ASTM A 116 Class 3.

2.6 MASONRY MORTAR

.1 CAN3-A8-M colour to be to Department Representative’s selection and shall depend on final brick and block selection. Intent is to match existing as closely as possible.

.1 Exterior Above Grade: Type N.

2.7 PRECAST STONE SILL

.1 Pre-cast concrete exterior grade sill as per contract drawings.

2.8 CAULKING

.1 Sika or approved equal.

2.9 STAINLESS STEEL VENEER ANCHORS

.1 Masonry veneer to wood stud: Wrap Tie system by Fero Connectors

.2 Masonry veneer to concrete block back-up: Wrap Tie system by Fero Connectors

.3 Where no rigid insulation to be Cat Tie System with AB clip and 'V' tie .4

.4 Where cavity wall use Wrap Tie System by Fero Connectors with 'L' plate,V' tie and insulation support .

.5 Note, where anchors have been specified by Structural, Structural specifications shall take precedence.

2.10 JOINT BREATHERS

.1 P.V.C. Brick Vent by Goodco Limited or Block-Lok Limited.

2.11 CONTROL JOINT

.1 To meet quality standard of Blok-Tite by Blok-Lok limited and be located as per drawings or at 6m intervals.

3 Execution

3.1 EXAMINATION

.1 Verify that site conditions are ready to receive work.

.2 Inspect materials for fit and finish prior to installation. Do not set unacceptable units.

.3 Beginning of installation means acceptance of site conditions.

3.2 LAY-UP

.1 Lay-up of the stone to have random pattern as per manufacturer's installation guide.

.2 Dressing of the stone (bellies) to be no greater than 35 percent of the total.

.3 Undressed stone to have 20 percent of the stone facing standing proud 25 mm – 50 mm on full coursing runs to create three (3) dimensional depth and shadowing.

3.3 PREPARATION

.1 Waterproof exterior slabs on back prior to setting.

.2 Clean stone surfaces by washing with stiff fibre brush and water.

3.4 INSTALLATION/TOLERANCES

.1 Variation from Plumb: plus or minus 6 mm per 3 metres maximum.

.2 Variation from Level: plus or minus 13 mm per 6 metres maximum.

.3 Variation from Linear Building Line: plus or minus 13 mm per 6 metres maximum.

.4 Variation in Cross-Sectional Dimensions: plus 13 mm or minus 6 mm.

3.5 SETTING STONE - GENERAL

.1 Construction in accordance with CAN/CSA A371.

.2 Reinforcement and anchorage in accordance with Section 04052 – Masonry Anchorage and Reinforcing.

.3 Set stones plumb, true, and level, to requirements as indicated and approved shop drawings.

.4 Align stone edges and faces according to established relationships and indicated tolerances.

.5 Provide movement joints of widths and at locations indicated. Ensure movement joints are kept free of mortar.

3.6 SETTING STONE WITH MORTAR

.1 Set stones in full bed of mortar with vertical joints buttered and placed full, except where otherwise specified.

.1 Completely fill anchor, dowel and lifting holes.

.2 Lay stone in random ashlar bond.

.1 Connect stone veneer to structural back-up with approved wall ties, spaced not more than 405 mm horizontally and 610 mm vertically.

.2 Shim and adjust supports to set stones accurately in locations indicated with uniform joints of widths indicated.

.3 Make joints 6 mm thick.

.4 Embed only ends of lugged sills and steps in mortar.

.1 Leave balance of joint open for final pointing.

.5 Place setting buttons under stones to maintain joint thickness.

.1 Set heavy stones and projecting courses after mortar in courses below has hardened sufficiently to support weight.

.2 Soft-wood wedges are not acceptable.

.6 Brace and anchor projecting stones until wall above is set.

.7 Install Precast Concrete Sills and Precast Concrete Bands where shown on Drawings.

.8 Use soaked softwood wedges to support stone in proper alignment until mortar has set.

.1 Remove wedges when dry and without breaking them off, fill voids with pointing mortar.

.9 Install through-wall flashing membranes at continuous shelf angles, steel lintels, ledges and similar obstructions to the downward flow of water.

.10 Install weep hole vents at 800 mm on centre horizontally above through-wall flashing, above shelf angles and at bottom of walls.

.11 Tool joints after initial set has occurred.

.12 Rake out joints to 25 mm depth and make ready for pointing with pointing mortar.

.1 Sponge stone face along joints and remove droppings and splashed mortar immediately.

.13 Grouting: pack ends of exposed joints with plastic foam joint filler and after wetting ends of stone, fill joint with grouting mortar to within 19 mm of top.

.1 Grout vertical joints of copings, projecting belt courses, steps and platforms.

.2 After grout has set, remove packing for pointing.

.14 Pointing: remove dirt and loose mortar from joints by using pressurized airstream.

.1 Wet joints for mortar pointing. Dry joints for sealant pointing.

.2 Point joints with pointing mortar in three stages. Rub smooth with appropriate tool to slightly concave joint.

.3 Point control joints with sealant. Do work in accordance with Section 07900 -Sealants.

3.7 CLEANING

.1 Clean stone as work progresses.

.1 Allow mortar droppings on stone to partially dry then remove by means of brushing with a stiff fibre brush.

.2 Post-Construction: Clean 10 m² area of wall designated by Engineer as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, clean masonry as follows:

.1 Protect windows, sills, doors, trim and other work from damage.

.2 Remove large particles with stiff fibre brushes and/or wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.

.3 Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 litre of clean water using stiff fibre brushes, then clean off immediately with clean water using hose or as recommended by manufacturer.

.4 Repeat cleaning process as often as necessary to remove mortar and other stains.

.3 Use alternative cleaning solutions and methods for difficult to clean stone only after consultation with masonry unit manufacturer.

3.8 PROTECTION

.1 Protect stone from damage resulting from subsequent construction operations.

.2 Use protection materials and methods which will not stain or damage stone.

.3 Remove protection materials upon Substantial Performance of Work, or when risk of damage is no longer present.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 Coordinate with

.3 Conform to the National Building Code of Canada, the Construction Safety Act, CSA Standard S16.1-M (latest edition) and applicable Provincial building code. All codes and standards shall be current editions with all revisions to date.

.4 Co-operate with other trades for satisfactory completion of the Work.

.5 Where structural steel members specified on the drawings are not available to the Contractor, the Structural Steel Contractor shall provide members having all section properties equal to or better than the specified members at no additional cost. Contact Engineer for acceptance of any and all substitutions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Contractor shall be responsible for co-ordinating this section with all related sections.

.2 Specifications and General Notes listed on Drawing S1.

1.3 QUALITY ASSURANCE

.1 Execute work of this Section only by a structural steel fabricator who is fully accredited and a current member of the Canadian Institute of Steel Construction.

.2 Any organization undertaking to weld under this contract shall be fully approved by the Canadian Welding Bureau under the requirements of CSA W47.1 (latest edition), W55.3 (latest edition) and CSA W59 (latest edition).

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Prepare and submit shop and erection drawings which conform to the requirement of the General Conditions and Section 01 33 00, CAN/CSA S16.1-M (latest edition), and as specified herein.

.2 Show the size, spacing and location of structural steel connections, attachments, reinforcing and anchorage. Include necessary plans, elevations and details. Indicate size and type of fastening. For welded connections, use welding symbols in compliance with AWS and indicate clearly net weld lengths.

.3 Submit typical details of connections and any special connections for review by the Consultant before preparation of shop drawings.

.4 Review of shop drawings by the Architect and Engineer will not absolve the Contractor from his responsibility of providing materials and equipment to complete and finish his work in accordance with the Contract Documents. Departures or differences from the reference drawings shall be approved, in writing, by the Architect/Consultant.

.5 The Subcontractor shall include in his delivery schedule a minimum of two (2) weeks for Consultant review of shop drawings.

.6 All connections to be designed by a qualified Engineer registered to practice in the Province of construction.

.7 All shop drawings are to be signed and sealed by a qualified Engineer registered to practice in the Province of construction, who shall take responsibility for the design of all connections.

.8 Do not use Contract Documents as shop drawings or erection drawings. Contract Documents used for this purpose will not be reviewed. Delays resulting from this procedure will be the responsibility of the Contractor.

1.5 INSPECTION AND TESTING

.1 Qualified inspectors will be employed by the Owner for this Work. Inspection organization undertaking to inspect welding shall be qualified in accordance with the requirements of CSA W178.1 (latest edition) 'Qualification Code for Welding Inspection Organizations' and approved by the Canadian Welding Bureau.

.2 Provide free access for inspectors to all places where Work is being done.

.3 Inspectors are to ensure that materials conform with the requirements of this Specification.

.4 Mill test reports, properly correlated to the materials, will be accepted in lieu of physical tests.

.5 Inspection shall include:

.1 Shop inspection of fabrication in the plant.

.2 Identification of material grades.

.3 Check of overall dimensions.

.4 Check of cambers.

.5 Check of workmanship regarding layout, punching and reaming of holes.

.6 Shop and field inspection of bolted connections.

.7 Shop and field inspection of welded joints.

.8 General inspection of field cutting and alterations.

.9 General inspection of shop priming and field touch-up. spandrel

.6 The installation and testing of bolts shall conform to the requirements CAN/CSA S16.1-M (latest edition). Inspector shall check one (1) representative connection in ten (10) by torque testing each bolt, and shall check each bolt in every connection with a tap of a hammer for soundness. Inspectors shall enforce the requirements of the connection type.

.7 Inspector shall examine visually all welded joints for inclusions, porosity, lack of fusion, penetration, contour, under-cuts and cracks. Root passes shall be checked for penetration and cracks from the back of the joint. When directed by the Consultant, have one (1) representative weld in ten (10) and every weld in direct tension tested ultrasonically.

.8 Inspector shall make full prompt written report to the Architect of all inspections and tests. Circulate reports to the Architect (two (2) copies), Engineers (one (1) copy), General Contractor (two (2) copies), Owner (one (1) copy) and Authorities having jurisdiction.

.9 Steel materials and workmanship not conforming to this Specification will be rejected. Remove and replace defective materials without unnecessary delay and without extra cost.

1.6 DESIGN

.1 Design connections in accordance with the Handbook of Steel Construction by the Canadian Institute of Steel Construction for loads shown or required.

.2 Conform to the National Building Code of Canada (latest edition) and applicable Provincial Building Codes and subsequent updates, CAN/CSA S16.1 (latest edition), local by-laws and regulations.

.3 Top of beam elevations given in relation to the underside of steel deck levels shall be:

.1 Beams support joists: Underside of joist shoe

.2 Beams not Supporting joist: 0

.3 Other: As noted on plans/sections

1.7 DELIVERY, STORAGE AND HANDLING

.1 Co-ordinate deliveries to comply with Construction Progress Schedule and arrange ahead for off-the-ground storage location. Do not load any area beyond the design limits.

.2 Adequately protect steel against rust and damage during manufacturing, delivery and storage.

.3 Store material on planks on a dry area and protect from damage. Make good immediately any damage done, clean scratches and the like, touch-up with specified primer.

2 Products

2.1 MATERIALS

.1 Structural Steel: New stock (not weathered or rusted); to conform to CAN/CSA-G40.20/G40.21 (latest edition), Grade 350W.

.2 Hollow Structural Sections: (HSS); New stock; to conform to CAN/CSA-G40.20/G40.21 (latest edition), Grade 350W, Class H, stress relieved.

.3 Provide high strength bolts in compliance with ASTM Standard A325 (latest edition) - High Strength Bolts for Structural Steel Joints, including suitable nuts and plain hardened washers.

.4 Provide welding electrodes in compliance with CSA W48-Series - Mild Steel Covered Arch Welding Electrodes. Welding materials shall conform to CSA W59 (latest edition).

.5 Structural Steel Primer: CAN/CGSB-1.40-M (latest edition), Structural Steel, Oil Alkyd Type or CAN/CGSB-140-M (latest edition): Red Lead, Iron Oxide, Oil Alkyd type and zinc rich paint to approved manufacturer's specifications containing 85% zinc in dry film for exterior exposed members. Shop coat and on-site touch-up shall be no less than 0.5 mils thickness.

.6 Touch-Up Primer: CAN/CGSB-1.181 (latest edition), zinc rich organic primer, 'Gild Zinc 100' by ICI Paints Canada Inc., or other approved manufacturer.

.7 Commercial galvanizing to conform to CSA Standard G164-M (latest edition).

.8 Welded studs shall be by an approved manufacturer such as TRW Nelson and shall conform to CSA Standard W59 (latest edition).

3 Execution

3.1 PREPARATION RELATED TO OTHER TRADES

.1 As the work of other trades progresses, supply anchor bolts, adjustable lintel inserts, bearing plates, lintels and other members required to be built-in with the work of other trades.

.2 Give necessary instructions to other trades for setting bearing plates, anchor bolts and other members to be built-in with the work of other trades.

.3 Verify the locations and elevations of concrete foundations and anchor bolts for column bases before standing columns, or commencement of erection will be deemed to represent acceptance of the previous work and conditions.

3.2 FABRICATION

.1 Fabrication of structural members shall comply with CSA S16.1-M (latest edition) and as specified below.

.2 Use only clean and straight material. If straightening or flattening is necessary, do it only by a process and in a manner that will not injure the material. Material having kinks or bends not called for on the drawings will be rejected.

.3 Shop or field connections shall be bolted with high strength bolts or welded. Connections shall be made with due regard for Architectural drawings and appearance. **DO NOT** interfere with clearance lines or architectural finishes.

.4 Minimum size of welds to be 5mm.

.5 Beam connections shall be adequate to resist the reactions produced by the framing or load conditions.

.6 Provide double angle header connections where practical. Otherwise use seat connections with top clip angles for lateral support.

.7 Header connections shall be used at all expansion joints for structural steel.

.8 Minimum length of double angle header connections shall not be less than half of the depth of the beams.

.9 Do not use one-sided or fish plate type connections.

.10 Provide top and bottom flange angle clips for all spandrel beams.

.11 Provide punched holes 11mm to 27mm in diameter for convenience of other trades in attaching wood or other materials to steel work, when so directed by the Architect. Holes shall be so placed as not to cause any appreciable reduction in the strength of the member.

.12 Provide holes for pipes and ducts and the reinforcing for same as indicated on drawings. Cutting of holes in steel beams in the field will not be permitted, without the written approval of the Consultant.

.13 Provide separators at approximately 1200mm O.C. for double beams and channels as follows:

.1 Beams and channels 200mm or less in depth: One (1) or two (2) rows of pipe separators.

.2 Beams and channels over 200mm in depth: Channel separators unless otherwise detailed on the drawings.

.14 Mill column bearing plates under column bearing.

.15 Structural steel members shall not be spliced unless approved by the Structural Engineer in writing.

.16 Provide 50mm clear space between structural steel at expansion joints.

.17 Provide adjustable galvanized steel anchors 40mm x 6mm on columns that abut masonry for anchoring every 400mm in height.

.18 Provide adjustable galvanized steel anchors 40mm x 6mm on beams that abut masonry at 400mm O.C. vertically and 2000mm O.C. horizontally.

.19 Welding shall comply with CSA W59 (latest edition).

.20 Fabricator shall be approved by the Canadian Welding Bureau under the requirements of CSA W47.1 (latest edition).

3.3 SHOP PAINTING AND PROTECTION

.1 Clean steel by shot-blasting or power wire brushing to remove rust, mill scale, oil, dirt and other foreign matter before commencing shop painting. The quality of cleanliness shall be of standard stated in SSPC-SP6 Commercial Blast Cleaning, or SSPC-SP3 Power Tool Cleaning, as may be required to satisfy final paint finish requirements.

.2 Clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.

.3 All steel work shall receive one (1) shop coat of exterior grade primer.

.4 Steel work shall be painted and shall remain under cover until the paint protection has dried.

.5 Give the parts which are inaccessible after assembly two (2) coats of primer coat paint, of different colours, when members are noted to be painted.

.6 Provide sandblasting before finish painting for steel members at edge of openings, as shown on drawings.

.7 Steel work shall be left installed in a clean state ready to receive applicable finishes.

.8 Where steel is to be covered with sprayed fireproofing, ensure that paint primer used is compatible with sprayed fireproofing.

.9 The following surfaces shall not be painted:

.1 Surfaces and edges to be field welded, except joist surfaces to receive steel decking. IF painted, remove paint for field welding for a distance of at least 50mm on all sides of the joint.

.2 The contact surfaces of friction-type connections assembled by high strength bolts.

.3 Portions of steel members which are to be encased in, or in contact with, concrete slabs cast-in-place.

.4 All exterior exposed steel shall be galvanized or painted with approved rust inhibitive paint.

3.4 ERECTION

.1 Make adequate provision for horizontal and vertical erection loads and for sufficient temporary bracing to keep structural steel plumb and in true alignment until the completion of erection and installation of concrete work and roof decks which provide the necessary permanent bracing. Any failure to make proper and adequate provisions for erection stresses shall be entirely at the risk and responsibility of the Contractor.

.2 When temporary steel members are required for erection purposes, such members shall be provided and removed when no longer required.

.3 Handle and store structural steel on the job site in such a manner that no damage shall be caused to the material, or the structure.

.4 Erect individual members of the structural steel to the following tolerances:

.1 Exterior columns, spandrel beams and angles: 1 to 1000.

.2 All other pieces: 1 to 500.

.3 Adjustable Shelf Angles attached to steel frame: 3mm plus or minus, with abutting ends of members at the same level. These elements shall be welded in place after final adjustment and galvanizing shall be touched-up with zinc rich paint.

.4 A variation of 1.5mm is permissible in the overall length of members with both ends milled. Members without milled ends which are to be framed to other steel parts of the structure may have a variation from the detail length not greater than 2.5mm for members 9000mm or less in length, and not greater than 3mm for members over 9000mm in length.

.5 Execute all field assembly and welding in accordance with the requirements for shop fabrication excepting such as manifestly apply to shop conditions only.

.6 Provide bearing plates and standard government wall anchors for beams bearing on masonry or concrete.

.7 Provide 150mm bearing for angle lintels and bolt or weld together upstanding legs. Maximum spacing of bolts or welds shall be 600mm.

.8 Paint field bolts, field welds and any abrasions or damage to the shop coat or primer, after erection.

.9 Provide C100 x 8 structural members for framing at perimeter of holes through metal decking where openings between 450mm and 1200mm in roof deck and between

300mm and 1200mm in floor deck measured across flutes. Connect to main framing members.

3.5 ARCHITECTURALLY EXPOSED STEEL

.1 Where finished surfaces of steel are to be left exposed to view, fabricate as specified in AISC Specification for Architecturally Exposed Steel, including specified straightness.

.2 Continuously weld connection joints where exposed to view, and grind them smooth and flush with adjacent surfaces.

.3 Remove mill marks, identification and surface imperfections by grinding smooth and flush with adjacent surfaces.

.4 Clean, prime and protect all steel as specified in this Section. Apply one (1) coat of primer compatible with finish specified in Section 09 90 00.

END OF SECTION

1 General

1.1 INTENT

.1 Provide all miscellaneous metal items as detailed on the Architectural drawings, specified herein or required for the proper execution of the project including but not limited to those listed below. Provide each item complete with all the required anchorage and such accessories as are necessary for the proper installation and for correlation with adjoining work.

1.2 SUMMARY

.1 Section Includes:

.1 Steel ladder.

.2 Steel Handrails.

.3 Steel Guards.

.4 Steel framing not shown on structural drawings but required by architectural details e.g. deck table framing.

.5 Miscellaneous Steel items and brackets as shown/noted on architectural drawings.

.2 Miscellaneous steel for lateral bracing of tops of block partitions to be supplied and installed by Section 05 12 23 – Structural Steel for Buildings.

.3 Related Requirements:

.1 Section 03 30 00 – Cast-in-place Concrete.

.2 Section 04 22 00 – Masonry.

.3 Section 09 91 00 – Painting.

1.3 REFERENCES

.1 ASTM International

.1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269-08, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16-09, Design of Steel Structures.

.4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.

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

.1 Material Safety Data Sheets (MSDS).

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing, bolts and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

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

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

1.5 QUALITY ASSURANCE

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

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

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.

.2 Steel pipe: to ASTM A53/A53M standard weight, 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 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/m2 to CAN/CSA-G164.

.2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: MPI- INT EXT 5.1A, in accordance with chemical component limits.

.4 Zinc primer: zinc rich, ready mix to MPI-INT EXT 5.2C in accordance with chemical component limits.

2.4 ISOLATION COATING

.1 Isolate aluminum 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 Primer: VOC limit 250 g/L maximum.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 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.

.4 Clean surfaces to be field welded; do not paint.

2.6 CHANNEL FRAMES

.1 Fabricate frames from steel, sizes of channel and opening as indicated.

.2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.

.3 Finish: galvanized.

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 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 Consultant 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 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16. Weld field connection.

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

.1 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.8 Primer: maximum VOC limit 250 g/L.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250 g/L.

3.3 CHANNEL FRAMES

.1 Install steel channel frames to openings as indicated.

3.4 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.5 PROTECTION

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

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

END OF SECTION

1 General

1.1 NOTES

.1 All conditions of the Contract apply to the work of this Section.

.2 Report in writing to the General Contractor any defects of surfaces or work prepared by other Trades which affect the quality or dimensions of this Contractor's work. Commencement of this Contractor's work shall imply complete acceptance of all work by other Trades.

1.2 INTENT

.1 Provide all articles, labour, materials, equipment and transportation, hoisting and incidentals noted, specified or required to complete the work of this Section.

1.3 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications.

.2 Section 06 20 00 – Finish Carpentry.

1.4 REFERENCES

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

.1 ANSI/NAAMM MBG 531-00, Metal Bar Grating Manual.

.2 ASTM International

.1 ASTM A 53/A 53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength Metric.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

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

.1 Material Safety Data Sheets (MSDS).

.6 National Association of Architectural Metal Manufactures (NAAMM)

.1 AMP 510-92, Metal Stair Manual.

.7 The Society for Protective Coatings (SSPC)

.1 Systems and Specifications Manual, Volume 2, 2008 Edition.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Shop Drawings:

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

.2 Indicate construction details, sizes of steel sections and thickness of steel sheet.

1.6 QUALITY ASSURANCE

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

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

1.7 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect stairs and ladders from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 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.

2.2 MATERIALS

.1 Steel sections: to CSA G40.20/G40.21 Grade 300 W.

.2 Steel plate: to CSA G40.20/G40.21, Grade 260 W, pattern checkered plate.

.3 Floor plate: to CSA G40.20/G40.21, Grade 260 W.

.1 Thickness: as indicated on drawings.

.2 Width: as indicated on drawings.

.3 Design: as indicated on drawings.

.4 Steel pipe: to ASTM A 53/A 53M, standard weight, schedule 40 seamless black.

.5 Steel tubing: to CSA G40.20/G40.21, Grade 260 W, sizes and dimensions as indicated.

.6 Metal bar grating: to ANSI/NAAMM MBG 531, steel, Type W-19-4, with checkered plate abrasive nosings.

.7 Welding materials: to CSA W59.

.8 Bolts: to ASTM A 307.

.9 High strength bolts: to ASTM A 325M.

2.3 FABRICATION

.1 Fabricate in accordance with 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:

.1 Make mitres and joints tight.

.2 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.

2.4 PLATE/GRATING STAIRS

.1 Form treads from 6mm thick steel plate to profile indicated, and secure to stringers with L 35 x 35 x 5 supports. Form landings from 6mm thick steel plate, reinforced by L 55 x 55 x 6 spaced at 600mm on centre.

.2 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.

.3 Form stringers from C 310 x 37.

2.5 PIPE/TUBING BALUSTRADES

.1 Construct balusters and handrails from steel pipe.

.2 Cap and weld exposed ends of balusters and handrails.

.3 Terminate at abutting wall with end flange.

2.6 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600g/m² 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.

2.7 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.

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION 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.

3.3 CLEANING

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

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

.2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

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

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by metal stairs and ladders installation.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 20 00 – Finish Carpentry.

1.2 REFERENCES

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

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

.2 ASTM International

.1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.

.3 ASTM C578-11a, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

.4 ASTM C1289-11, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.5 ASTM C1396/C1396M-11, Standard Specification for Gypsum Board.

.6 ASTM D1761-06, Standard Test Methods for Mechanical Fasteners in Wood.

.7 ASTM D5055-11, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.

.8 ASTM D5456-11, Standard Specification for Evaluation of Structural Composite Lumber Products.

.3 Canadian General Standards Board (CGSB)

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

.2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.3 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.

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

.4 CSA International

.1 CAN/CSA-A123.2-03(R2008), Asphalt Coated Roofing Sheets.

.2 CAN/CSA-A247-M86(R1996), Insulating Fiberboard.

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

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

.5 CSA O121-08, Douglas Fir Plywood.

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

.7 CSA O141-05(R2009), Softwood Lumber.

.8 CSA O151-09, Canadian Softwood Plywood.

.9 CSA O153-M1980(R2008), Poplar Plywood.

.10 CSA O325-07, Construction Sheathing.

.11 CSA O437 Series-93(R2011), Standards on OSB and Waferboard.

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

.5 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Shop Drawings:

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

1.4 QUALITY ASSURANCE

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

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

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

.1 Description:

.1 Sustainability Characteristics:

.1 Lumber, Finger Jointed Lumber, Trusses, SCL, CAN/CSA-Z809 or FSC or SFI certified.

.2 Plywood, Particleboard and OSB urea-formaldehyde free, CAN/CSA-Z809 or FSC or SFI certified.

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

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 Glued end-jointed (finger-jointed) lumber NLGA Special Products Standard.

.4 Light-frame trusses in accordance with "Truss Design and Procedures for Light Metal Connected Wood Trusses", The Truss Plate Institute of Canada.

.5 Structural Composite Lumber (SCL) in accordance with ASTM D5456.

.6 Framing and board lumber: in accordance with NBC.

.7 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.

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

.9 Douglas fir plywood (DFP): to CSA O121, standard construction.

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

.11 Poplar plywood (PP): to CSA O153, standard construction.

.12 Gypsum sheathing: to ASTM C1396/C1396M.

2.2 ACCESSORIES

.1 Polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15 mm thick.

.2 Roll roofing: to CAN/CSA A123.2, Type S.

.3 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Sealants: VOC limit 250 g/L maximum.

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

.1 Adhesives: VOC limit 120 g/L maximum.

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

.1 VOC limit 200 g/L maximum.

.6 Nails, spikes and staples: to CSA B111.

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

.8 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.

.9 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.

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

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

.12 Fastener Finishes:

.1 Galvanizing: to ASTM A123/A123M ASTM A653, use galvanized fasteners for exterior work interior highly humid areas pressure-preservative fire-retardant treated lumber.

.13 Wood Preservative:

.1 Preservative: in accordance with manufacturer's recommendations for surface conditions:

.1 Preservative: VOC limit 350 g/L maximum.

.2 Coatings: VOC limit 350 g/L maximum.

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

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

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as follows:

.1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.

.2 Wood furring for exterior wall siding framing.

.3 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.3 MATERIAL USAGE

.1 Roof Insulation Sheathing:

.1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, pressure treated, T G square edge, 19 mm thick.

.2 Exterior wall sheathing:

.1 16 mm plywood, as indicated in Section 09 21 16.

.3 Blocking:

.1 Wood blocking for all wall mounted fixtures and accessories as indicated.

3.4 INSTALLATION

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

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

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

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

.5 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.

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

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

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

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

.9 Install sleepers as indicated.

.10 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

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

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

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

3.5 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.6 PROTECTION

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

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete all glued-laminated construction, including modifications to existing glued-laminated members, including the complete installation of all hardware all other items, to the full intent of the drawings and as herein specified herein.

.2 Cooperate with other trades for satisfactory completion of the Work.

1.2 RELATED REQUIRMENTS

.1 Section 05 50 00: Miscellaneous Metals

.2 Section 06 10 00: Rough Carpentry

.3 Section 09 90 00: Painting

.4 Dwg. S1 & S11: Structural General Notes & Wood Canopy Design Loads

1.3 QUALITY ASSURANCE

.1 Certification:

.1 The glued-laminated elements shall be fabricated and erected by a manufacturing plant certified by the Canadian Standards Association in the appropriate category(ies) according to CSA Standard 0177-06 (R2011), Class X, Qualification Code for Manufacturers of Structural Glued-Laminated Timber.

.2 The glued-laminated timber manufacturer shall be certified in accordance with CSA's certification procedures for glued-laminated timber plants prior to submitting his tender and shall specifically verify as part of his tender that his plant is currently certified in the appropriate category(ies).

.3 Only glued-laminated elements fabricated in such certified plants shall be acceptable to the Owner and plant certification shall be maintained for the duration of the fabrication and erection for this project.

.2 Contractor executing work of this section shall have a minimum of five (5) years continuous Canadian experience in successful manufacture/fabrication and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.3 Follow applicable requirements of CSA Standard 0122-06 (R2011) Structural Glued-Laminated Timber, including all supplements and modifications.

.4 Structural steel elements shall conform to requirements of CAN/CSA-S16-09, Design of Steel Structures, and CAN/CSA-S136-07, Cold Formed Steel Structural Members.

.5 Any organization undertaking to weld under this contract shall be fully approved by the Canadian Welding Bureau under the requirements of CSA W47.1-09 and W55.3-08.

.6 Supplements and modifications to the above standards as indicated on the drawings or as specified herein shall govern work of this section.

.7 Regular site reviews of the erection must be performed by the stamping shop drawing engineer and reports outlining and deficiencies and corrective measures to be provided to AECOM for review.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Prepare and submit shop and erection drawings which conform to the requirements of the General Instructions, CAN3-086M, and as specified herein.

.2 Shop drawings for glued-laminated structural units shall indicate the size, stress grade, service grade, and appearance grade, shop applied finishes, camber, cuts, holes and connection details. Include necessary plans, elevations and details. Indicate size and type of fastening. For weld connections use welding symbols in compliance with AWS and indicate clearly net weld lengths.

.3 Submit typical details of connections and any special connections for approval before preparation of shop drawings.

.4 Shop drawings submitted shall bear the seal of a Registered Professional Engineer, licensed in the place of the Work, responsible for the design of items supplied by the manufacturer.

.5 Review of shop drawings by the Consultant will not absolve the Contractor from the responsibility of providing materials and equipment to complete and finish the work in accordance with the architectural and structural drawings. Departures or differences from the referenced drawings shall be approved in writing by the Consultant.

.6 The Subcontractor shall include in his delivery schedule a minimum of two (2) weeks for Consultant review of shop drawings.

.3 Samples:

.1 Submit two (2) samples of glued-laminated material showing quality, texture, finish and colour, representative of proposed glued-laminated members, for approval prior to fabrication.

1.5 DELIVERY, STORAGE, HANDLING & PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, under cover storage locations. Do not load any area beyond the design limits.

.2 Wrap glued-laminated members prior to leaving the plant with a suitable non-staining, waterproof covering.

.3 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Use padded non-marring slings for handling glued-laminated members. Protect corners from crushing with wood blocking.

.4 Store glued-laminated members, blocked off the ground and separated with wood strips away from high traffic areas. Ensure air may circulate around all faces of members.

.5 Slit underside of waterproof covering during storage on site. Do not deface member.

.6 Unsatisfactory materials shall be promptly removed from the site.

.7 Maintain waterproof coverings until members are completely installed, then remove coverings, completely.

.8 Adequately protect the structure and work of other sections during delivery, storage, handling and execution of the work of this section.

.9 Provide tools, plant and other equipment required for the proper execution of the work of this section.

2 Products

2.1 MATERIALS

.1 Glued-laminated timbers:

.1 Unless otherwise indicated on drawings, all glued-laminated timber shall be the highest quality appearance grade, stress grade as required, in accordance with CSA standards.

.2 Steel for connections: to CSA G40.21-04 (R2009), Type 300W.

.3 Galvanizing for steel: hot dipped, minimum zinc coating of 600 g/sq.m.

2.2 FABRICATION AND WORKMANSHIP

.1 Work shall be executed by skilled workers under the supervision of a competent foreman. All items shall be shop assembled, insofar as is practical.

.2 Make thorough examination of drawings and details, check anchorage, interfacing with work of other Sections and other factors influencing the installation of the work, and be fully cognizant of requirements.

.3 Glued-Laminated Timbers:

.1 Finished glued-laminated timbers shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity of colour, grain and texture.

.2 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other sections.

.3 Machine dressed work shall be properly machined, using sharp cutters, the finished work shall be free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding.

.4 Finished glued-laminated timbers shall be carefully sanded after fabrication to remove roughness and planer marks to leave a smooth scratch-free surface suitable to receive the stain/natural finishes to be applied over as specified in Section 09 90 00.

.4 Connectors and anchorage:

.1 Fabricate work to be concealed in final assembly where possible and where exposed, to be neat appearance, laid out in uniform and consistent manner acceptable to Consultant.

2.3 MOISTURE CONTENT

.1 Moisture content of glued-laminated timbers shall be between 7% and 15%.

2.4 FINISHES

.1 Wood items provided under this section shall be finished as part of the work of this section.

.2 All finishes and colours to be approved by Parks Canada and AECOM.

.3 Finish all interior glued-laminated members with oil and urethane finish as recommended by manufacturer for interior applications.

.4 Finish all exterior glued-laminated members with oil finish as recommended by manufacturer for exterior applications.

.5 Apply oil or stain to items providing uniform required stain colour(s).

3 Execution

3.1 PREPARATION RELATED TO OTHER TRADES

.1 As the work of the other trades progresses, supply anchor bolts, bearing plates and other members required to be built-in with the work of other trades.

.2 Give necessary instructions to other trades for setting bearing plates, anchor bolts and other members to be built in with the work of other trades.

3.2 CONDITION OF SURFACES

.1 Inspect and verify the locations and elevations and check surfaces of elements which the work of this Section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those on the Contract Documents and/or detrimental to the proper and timely installation of the work of this section. The decision regarding correct measures shall be obtained from the Consultant prior to proceeding with the affected work.

.2 Commencement of work indicates acceptance of surfaces and conditions.

3.3 INSTALLATION - GENERAL

.1 Make adequate provision for horizontal and vertical erection loads and for sufficient temporary bracing to keep structural glue-laminated timbers plumb and in true alignment until the completion of erection and installation of other work and roof decks which provide the necessary permanent bracing. Any failure to make proper and adequate provisions for erection stresses shall be entirely at the risk and responsibility of the Contractor.

.2 The erection sequence shall not place undue or eccentric stresses on the connections.

.3 When temporary members are required for erection purposes, such members shall be provided, and removed when no longer required.

.4 Do not field cut or alter members without Design Consultants written approval.

.5 Handle and store structural glued-laminated members on the job site in such a manner that no damage shall be caused to the material, or the structure.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 06 10 00 – Rough Carpentry

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A208.1-09, Particleboard.

.2 ANSI A208.2-09, Medium Density Fibreboard (MDF) for Interior Applications.

.3 ANSI/HPVA HP-1-10, American National Standard for Hardwood and Decorative Plywood.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Quality Standards, 1st edition, 2009.

.3 ASTM International

.1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 Canadian General Standards Board (CGSB)

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

.5 CSA International

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.

.2 CSA O121-08, Douglas Fir Plywood.

.3 CSA O141-05(R2009), Softwood Lumber.

.4 CSA O151-09, Canadian Softwood Plywood.

.5 CSA O153-M1980(R2008), Poplar Plywood.

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

.6 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

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

.8 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S104-10, Standard Method for Fire Tests of Door Assemblies.

.2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for plywood, particleboard, OSB, MDF, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

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

.2 Indicate details of construction, profiles, jointing, fastening and other related details.

.3 Indicate materials, thicknesses, finishes and hardware.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate 300 x 300 mm samples of materials indicated below.

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

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

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).

.2 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

.3 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.

.4 Wood fire rated frames and panels: listed and labelled by an organization accredited by Standards Council of Canada to CAN/ULC-S104 and CAN/ULC-S105.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect wood products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 MATERIALS

.1 Softwood lumber: S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 CAN/CSA-Z809 or FSC or SFI certified.

.3 NLGA Standard Grading Rules for Canadian Lumber.

.4 AWMAC custom premium grade, moisture content as specified.

.5 Machine stress-rated lumber is acceptable.

.6 Hardwood lumber: moisture content 19% or less in accordance:

.1 National Hardwood Lumber Association (NHLA).

.2 AWMAC custom grade, moisture content as specified.

.3 CAN/CSA-Z809 or FSC or SFI certified.

.2 Panel Material: urea-formaldehyde free

.1 CAN/CSA-Z809 or FSC or SFI certified.

.2 Douglas fir plywood (DFP): to CSA O121, standard construction.

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

.4 Hardwood plywood: to ANSI/HPVA HP-1.

.5 Poplar plywood (PP): to CSA O153, standard construction.

.6 Particleboard: to ANSI A208.1.

.7 Hardboard: to CAN/CGSB-11.3.

.8 Medium density fibreboard (MDF): to ANSI A208.2, density 640-800 kg/m3.

.9 Low density fibreboard: to CSA-A247M.

.10 Decorative overlaid composite panels.

.1 Decorative overlay, heat and pressure laminated with suitable resin to thickness indicated 12.7 mm thick MDF, urea-formaldehyde free core.

.2 Overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain (buff) balancing sheet.

.3 Furniture finish: Wood grain pattern, solid colour selected by Departmental Representative.

.4 Edge finishing: matching melamine and polyester overlay edge strip with self-adhesive.

.3 Plastic Laminate Covered Components:

.1 Plastic laminate face sheets: High pressure, paper based, melamine surfaced, laminated plastic sheets, conforming to CAN3-A172, with thickness tolerances in accordance with Table 1 of CAN3-A172 and plastic laminate grades as follows:

.1 General Purpose Grade (GP): Minimum 1.27mm (0.050") thick.

.2 Post-forming Grade (PF): Minimum 1.06mm (0.042") thick.

.2 Plastic laminate face sheet colour, gloss and texture: As selected by the Consultant from the manufacturers standard product line.

.3 Plastic laminate backing and liner sheets: High pressure, paper based, melamine surfaced, laminated plastic backing sheets, conforming to CAN3-A172, backing grade (BK), minimum 0.5mm (0.020") thick, colour as selected later by Consultant and by manufacturer of plastic laminate face sheets.

.4 Cores: Douglas Fir veneer core plywood, Select Sheathing-Tight Face, good two sides, sanded "B" faces and conforms to CSA 0121-08, or Canadian Softwood Ply veneer core

plywood, Select Sheathing-Tight Face, good two sides, sanded "B" faces and conforms to CSA 0151-09, 19mm (3/4") thick or thicknesses as indicated on drawings. Provide exterior, waterproof grade plywood veneer core for countertops to receive sinks and in "wet areas".

.5 Laminating Adhesive: CSA-0112, water resistant type.

.6 Draw Bolt Fasteners: 'K&V 516' by Knape & Vogt Canada. No substitutions allowed.

.4 Cabinet Hardware: All cabinet hardware shall in general, conform to CAN/CGSB-9.25, ANSI/BHMA A156.9-1982 and shall be as follows:

.1 Door/Drawer Pulls: 24mm (15/16") diameter x 100mm (4") centre to centre with 33mm (1-5/16") projection, solid aluminum "bow" type door/drawer pulls with matching bases, having "US28" finish and complete with mounting screws, '4484' and '4487' by Stanley Hardware, division of the Stanley Works. No substitutions allowed.

.2 Adjustable Steel Standards and Supports: Nickel plated steel, adjustable on 13mm (1/2") centres, '255 NP' standards and '256' shelf supports, by Knape & Vogt Canada. No substitutions allowed. Standards at 151mm (6") from top and bottom. One support per 305mm (12") length of standard.

.3 Hinges: 95 deg opening, self-closing, concealed casework type hinges for overlay doors, having dual adjustable with heat tempered steel working parts with bright nickel finish (US14), '1560 Series' by Stanley Hardware, division of the Stanley Works. No substitutions allowed.

.4 Silencers: Round vinyl, self-adhering type silencers. Provide 2 per door.

.5 Drawer Slides: Full extension, side mounting, zinc coated, steel ball bearing, medium duty rated, '1300 Series' by Knape & Vogt Canada. No substitutions allowed.

.6 Cabinet Locks: Single and double door cabinet cylinder locks to suit conditions by Best Lock Corporation. No substitutions allowed. Co-ordinate keying with the Owner/Tenant.

.7 Magnetic Catches: Cast aluminum type, '918' by Knape & Vogt Canada. No substitutions allowed.

.5 Wall Mounted Standards and Brackets:

.1 Wall Mounted Standards: 22mm (7/8") wide x 17.5mm (11/16") high 12 gauge heavy-duty wall mounted standards with 50mm (2") slot adjustment, 914mm (3') long with anachrome finish and capable of supporting 65 lbs./100 sq.ft., '87 ANO' by Knape & Vogt Canada. No substitutions allowed.

.2 Brackets: 305mm (12") heavy-duty steel brackets with single, moulded nylon cam lock lever and anachrome finish, '187LL ANO' by Knape & Vogt Canada. No substitutions allowed.

.3 Shelf Rests: Provide end, centre and front type shelf rests with anachrome finish, complete with rubber cushions as required and for joining 2 shelves on one bracket, '210 ANO' (end rest), '211 ANO' (centre rest), '212 ANO (front rest) and '129 RUB' (rubber cushion for rests), all by Knape & Vogt Canada. No substitutions allowed.

2.2 ACCESSORIES

.1 Nails and staples: to CSA B111; galvanized to ASTM A123/A123M for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.

.2 Wood screws: plain, steel, type and size to suit application.

.3 Splines: wood.

.4 Adhesive and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.5 VOC limit 250 g/L maximum.

2.3 FABRICATION AND WORKMANSHIP

.1 Work shall be executed by skilled carpenters under the supervision of a competent carpentry foreman. All items shall be shop assembled, insofar as is practical. Unless indicated otherwise comply with AWMAC Custom Grade requirements.

.2 Make thorough examination of drawings and details, check anchorage, interfacing with work of other sections and other factors influencing the installation of the work, and be fully cognizant of requirements.

.3 Finished woodwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity of colour, grain and texture.

.4 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other sections.

.5 Fabricate the work in a manner which will permit expansion and contraction of the materials without visible open joints.

.6 Mitre exposed corners; no end grain shall be visible in completed installation.

.7 Provide solid wood edging at exposed plywood edges.

.8 Provide wood mouldings and wainscot to profiles as indicated on drawings.

.9 Jointing of shop assembled work shall be by means of mortise and tenons, dowels, stub tenons, dovetails, dadoes, lock joints as applicable for the jointing condition.

.10 Accurately cut, mitre, fit and frame work together to produce tight hairline joints, rigidly secured together in a permanent manner using glue, blind screw fixing or nails. Use concealed glue blocks for additional strength where possible.

.11 Finished woodwork shall be in one piece wherever possible and all trim shall be in long lengths. Where jointing is necessary in the length, the joints between pieces shall be scarfed, glued and properly fastened. The material being jointed shall match reasonably well for grain and colour where natural finish is specified. Joints between lengths where paint finish is to be applied may be finger jointed in lieu of scarfing. Trim shall be accurately cut and mitred at all corners, glued and properly fastened.

.12 Machine dressed work shall be properly machine using sharp cutters, the finished work shall be free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding.

.13 Finished woodwork shall be carefully hand sanded after installation to remove roughness and planer marks. Sanding shall be done with the grain of the wood and finished with fine grit paper to leave a smooth scratch-free surface suitable to receive the paint or natural finishes to be applied over as specified in Section 09 91 00.

.14 Nail heads in the finished surfaces shall be set with straight shank nail sets. Screw and bolt heads in finished surfaces shall be let into the work and capped with edge grain wood caps dressed and finished flush.

.15 Provide cutouts for sinks, fixtures, fittings, inserts, outlet boxes, services, other mechanical and electrical items and appliances. Round corners, and chamfer edges. Where items for cutouts butt to underside or back of finished surface, finish exposed edge to match face. Where item covers cutout, and at all concealed cut edges of core material, apply uniform coating of seal to cut edges.

.16 The finished work shall be of a high quality, with all corners having exact angles to ensure no swerve or twisting. All bends, crimps or angle parts shall be produced by professional equipment and tools for this purpose and if long runs or repeats are required, such shall be produced in the shop, or have proper equipment on site.

.17 Counters, Cabinets and Fitments:

.1 Provide and install counters, cabinets, and fitments as indicated on drawings.

.2 Shop fabricate and finish countertops and cabinet work in as large a size as practical. Verify field dimensions and conditions prior to fabrication.

.3 Make each unit rigid and self-supporting, suitable for individual removal. Assemble components with dovetail connections, mortise and tenon or blind dado joints, and adequately glued and secured with screws.

.4 Construct cabinets of solid lumber framing, with 19mm plywood gables. Provide 19mm plywood bottoms. Provide minimum 6mm thick plywood full width backs having joints concealed behind framing. Backs which support shelves, equipment, or other loads, shall be 19mm thick plywood. Route backs into end gables.

.5 Fabricate cabinet base in wood, separately in height indicated or, if not indicated, to match flooring base.

.6 Fabricate cabinet doors of flush panels from 19mm thick plywood framed with hardwood edging.

.7 Make drawer fronts of 19mm finished plywood, and wide enough to cover slide space. Provide 13mm drawer backs, 16mm sides, 6mm dividers, and 6mm bottoms, all of finished plywood. Fasten sides to fronts with dovetail joints, and grooved and glued joints for backs. Groove and glue bottoms into fronts and sides.

.8 Drawers shall be supported and guided with side extension drawer slides.

.9 Where a locking drawer is located below another drawer, provide 6mm thick plywood diaphragm in framing immediately above locking drawer.

.10 Fabricate shelving of 19mm finished plywood. Route cabinet gables to receive fixed shelving where indicated and to receive recessed metal shelf standards flush with adjacent surfaces for adjustable shelving.

.11 Fabricate countertops to details shown of 19mm plywood. Provide exterior grade waterproof Douglas Fir plywood for countertops to receive sinks. Fit corners and edges of countertops with solid stock. Extend side and backsplashes to heights indicated. Provide side returns to match backsplashes at all abutting fixed vertical surfaces.

.12 Support counters without cabinets below on solid wood framing, and plywood gables.

.13 Provide plywood shelf units with finished plywood cleats for shelving and coat rod installations. Provide closet rods with end flanges and intermediate supports.

2.4 PLASTIC LAMINATE COVERED COMPONENTS:

.1 Bond plastic laminate to core with adhesive using pressure. Provide balanced construction with plastic laminate face sheet on exposed sides of core and backer/liner sheet. Finish drawers with liner sheet on both sides of core for balanced construction.

.2 Unless otherwise detailed, provide 19mm (3/4") thick core.

.3 Apply plastic laminate to core material in accordance with adhesive manufacturer's instructions. Provide same core and laminate profiles to provide continuous support and bond over entire surface.

.4 Use continuous lengths.

.5 Form shaped profiles and bends using postforming grade laminate to laminate manufacturer's instructions.

.6 Where curved or bent surfaces are required for counters, backsplashes and other areas, use postforming laminate.

.7 Self-edge straight-line-edging with general purpose laminate and radius corners with postforming laminate, of same colour and finish as facing sheet, to cover exposed edges of core material. Apply with same adhesive as facing sheet. Chamfer edges uniformly at approximately 20 deg using machine router. Do not mitre laminate edges.

.8 Fabricate horizontal wearing surfaces including counters, shelves, both sides of removable shelves, cabinet doors and drawer fronts, of general purpose laminate except where postforming is required.

.9 Use general purpose laminate for exposed vertical surfaces except where otherwise specified or indicated.

.10 Apply plastic laminate backing sheet to reverse side of core of plastic laminate finished work including under counter tops and concealed portions of plastic laminate faced work. Provide backing sheet of specified minimum thickness, increased as required to compensate stresses caused by facing sheet.

.11 Apply laminated plastic liner sheet to interior of cabinetry unless indicated otherwise.

.12 Where cutouts are required in countertops for items that butt to underside of top only, trim edges of opening with postforming laminate. Use radiused corners and chamfer edges around cutouts to avoid chipping laminate. Where item covers cutout, apply uniform coating of sealer to cut edges.

.13 Assemble work, true and square. Arrange adjacent parts of continuous laminate work to match in colour and pattern.

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Do finish carpentry to Quality Standards of (AWMAC).

.2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.

.3 Form joints to conceal shrinkage.

3.3 CONSTRUCTION

.1 Fastening:

.1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.

.4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

.2 Standing and running trim:

.1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.

.2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.

.3 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.

.4 Install door and window trim in single lengths without splicing.

.3 Interior and exterior frames:

.1 Set frames with plumb sides, level heads and sills and secure.

.4 Shelving:

.1 Install shelving on shelf brackets or as indicated.

3.4 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.5 PROTECTION

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

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

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of exterior architectural woodwork including; but not limited to, the following:

.1 Custom wood sliding barn door.

.2 Exterior wood standing and running trim.

.3 Exterior wood frames and jambs.

.4 Exterior wood seating.

.5 Exterior wood ornamental work.

.6 Shop priming exterior woodwork.

.7 Site finishing of exterior woodwork.

.8 Shop finishing exterior woodwork.

1.2 REFERENCE STANDARDS

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

.1 ASTM D523-89, Standard Test Method for Specular Gloss

.2 Architectural Woodwork Manufacturing Association of Canada (AWMAC):

.1 AWMAC Architectural Woodwork Quality Standards Illustrated, 8th Edition, Version 1.0, 2003

1.3 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Submit product data for each type of product and process indicated and incorporated into items of exterior architectural woodwork during fabrication, finishing, and installation.

.3 Submit shop drawings indicating location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components as follows:

.1 Show locations and sizes of blocking and nailers, including concealed blocking and reinforcement specified in other Sections.

.4 Submit coating manufacturer's literature indicating compatibility of sealers, primers and finish coatings with specified wood species and exposure classifications.

1.4 QUALITY ASSURANCE

.1 Architectural Woodwork Quality Standards Illustrated (AWMAC Manual) published by the Architectural Woodwork Manufacturers Association of Canada (AWMAC), together with authorized additions and amendments will be used as a reference standard and forms part of this project specification, and as follows:

.1 Modifications made in this Section that change the requirements of the AWMAC Manual will govern in case of conflict.

.2 References to Economy, Custom or Premium Grade in this specification are as defined in the AWMAC Manual; any item not given a specific quality grade will be Premium Grade as defined in the AWMAC Manual.

.3 Provide a copy of the AWMAC Manual for reference purposes on the job site.

.4 References in this specification to part and item numbers mean those parts and items contained within the AWMAC Manual.

.2 Use a fabricator that employs skilled workers capable of custom fabricating products similar to those required for this Project and whose products have a record of successful in-service performance [using a woodworking shop that is a member of [AWMAC] [and is a certified participant in AWMAC's Quality Certification Program]].

.3 Use an experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated and whose work has resulted in construction with a record of successful in-service performance.

Fire Test Response Characteristics:

.1 Provide materials and products with specified fire test response characteristics where fire retardant materials or products are indicated.

.2 Fire Test Response Characteristics shall be as determined by testing for identical products and test methods indicated by CSA, ULC, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

.3 Identify architectural woodwork materials with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.5 CLOSEOUT SUBMISSIONS

.1 Submit maintenance data for applied finishes in accordance with Section [01 78 23 – Operations and Maintenance Data] [01 00 06 – General Requirements: Operations and Maintenance Data].

.2 Submit three (3) copies of:

.1 Materials and finishes used for architectural woodwork and whether shop finished or site finished and by whom.

.2 Type and source of all cabinet hardware and any specialty items used under architectural woodwork.

1.6 PROJECT CONDITIONS

.1 **Weather Limitations:** Proceed with installation of exterior woodwork only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

.2 **Field Measurements:** Verify dimensions of other construction by field measurements before fabrication and indicate measurements on shop drawings where woodwork is indicated to fit to other construction:

.1 Coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on shop drawings.

.3 **Established Dimensions:** Establish dimensions and proceed with fabricating woodwork without field measurements where field measurements cannot be made without delaying the Work:

.1 Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

2 Products

2.1 MATERIALS

.1 Provide materials in accordance with AWMAC Manual quality standard for each type of woodwork and quality grade specified.

.2 Furring, Blocking, Shims, and Hanging Strips: Softwood, kiln dried to less than 15% moisture content.

.3 Anchors:

.1 Select material, type, size, and finish required for each substrate for secure anchorage.

.2 Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.

.3 Provide toothed steel or lead expansion sleeves for drilled-in-place anchors.

2.2 FABRICATION, GENERAL

.1 Wood Moisture Content: 10 to 15%.

.2 Fabricate woodwork to dimensions, profiles, and details indicated.

.3 Ease edges as follows:

.1 Edges for Lumber 19 mm Thick or Less: 1.5 mm.

.2 Edges for Lumber Greater than 19 mm Thick: 3 mm.

.4 Complete fabrication to maximum extent possible before shipment to Project site including assembly, finishing, and hardware application:

.1 Disassemble components only as necessary for shipment and installation.

.2 Provide ample allowance for scribing, trimming, and fitting where necessary for fitting at site.

.5 Shop cut openings to maximum extent possible to receive hardware, electrical work, and similar items:

.1 Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.

.2 Smooth edges of cut-outs and seal with water resistant coating suitable for exterior applications to match surface finish.

.6 Back cut or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

2.3 FINISHING

.1 Preparations surfaces ready for finishing by sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

.2 Back prime woodwork by applying one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork; apply two coats to end-grain surfaces and surfaces installed in contact with concrete or masonry.

.3 Finish exterior architectural woodwork to greatest extent possible at fabrication shop; perform only final touch-up and cleaning after installation.

3 Execution

3.1 PREPARATION

.1 Condition woodwork to average prevailing humidity conditions in installation areas before starting installation.

.2 Deliver concrete inserts and similar anchoring devices built into substrates in sufficient time before substrates are built.

.3 Examine shop fabricated work for completion before starting installation and verify that back priming is complete, that materials fit established dimensions indicated on shop drawings and that there are no defects detrimental to long term performance of installed exterior architectural woodwork.

3.2 INSTALLATION

.1 Scribe and cut woodwork to fit adjoining work, refinish cut surfaces and repair damaged finish at cuts to match shop applied coatings.

.2 Handle, store, and install fire retardant treated wood in accordance with chemical treatment manufacturer's written instructions, including requirements for adhesives used to install woodwork; treat cut ends and drilled holes in accordance with AWPA M4 where cut or drilled in field.

.3 Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk concealed fasteners and blind nailing. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.

.4 Install lengths of wood using minimum number of joints possible, using full length pieces from maximum length of lumber available to greatest extent possible:

.1 Do not use pieces less than 900 mm long, except where shorter single length pieces are necessary and have been accepted for use by the Consultant.

.2 Scarf running joints and stagger in adjacent and related members.

.5 Complete finishing work to extent not completed at shop or before installation of woodwork; fill nail and screw holes with matching filler where exposed; touch-up damaged or marred finishes using materials compatible with shop applied finishes.

3.3 ADJUSTING AND CLEANING

.1 Repair damaged and defective woodwork; where possible, to eliminate functional and visual defects; replace woodwork where not possible to repair.

.2 Adjust joinery for uniform appearance.

.3 Clean woodwork on exposed and semi-exposed surfaces.

.4 Touch up shop applied finishes to restore damaged or soiled areas.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 21 16 – Blanket Insulation

.3 Section 07 46 23 – Wood Siding

1.2 REFERENCES

.1 ASTM International

.1 ASTM C208-12, Standard Specification for Cellulosic Fiber Insulating Board.

.2 ASTM C591-13, Standard Specification for Un-faced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

.3 ASTM C612-14, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.

.4 ASTM C726-12, Standard Specification for Mineral Fiber Roof Insulation Board.

.5 ASTM C1126-14, Standard Specification for Faced or Un-faced Rigid Cellular Phenolic Thermal Insulation.

.6 ASTM C1289-14, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.7 ASTM E96/E96M-13, Standard Test Methods for Water Vapour Transmission of Materials.

.2 Canadian General Standards Board (CGSB)

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

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

.1 Material Safety Data Sheets (MSDS).

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.2 CAN/ULC-S702-2012 , Standard for Mineral Fibre Insulation for Buildings.

.3 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures. Indicate VOC's during application and curing.

.3 Shop Drawings:

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

.4 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports:

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

.6 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse by manufacturer and return of packaging materials pallets, padding, crates, in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 INSULATION

.1 Perimeter and Under slab Insulation Board:

.1 HIGHLOAD 40 XPS by DOW or approved equal

.2 Provide under slab insulation board with ship-lapped edges.

.2 Perimeter Foundation Insulation

.1 Closed-cell, cellular, foamed, smooth skin, extruded polystyrene, having 30 psi compressive strength, thicknesses as indicated on drawings and specified herein, conforming to CAN/ULC S701, Type IV.

.2 Provide under slab insulation board with ship-lapped edges.

.3 Exterior Wall Insulation Board:

.1 CAVITYMATE™ XPS Insulation by DOW or approved equal

.2 Fully adhered or mechanically fastened

.4 Exterior Roof Insulation Board:

.1 DECKMATE™ XPS Insulation by DOW or approved equal

.2 Fully adhered or mechanically fastened

.3 Coordinate with Roof Supplier to ensure compatibility to meet Warranty requirements

2.2 ADHESIVE

.1 Trowelable Polystyrene Insulation Adhesive: Trowel consistency, synthetic rubber based insulation adhesive compatible with polystyrene insulation in accordance with CGSB 71 GP 24M; suitable for application to temperature of -10 deg C or lower, as approved by insulation board supplier.

2.3 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.

.2 Mechanical Fasteners: High quality, impact resistant plastic fastener system specifically designed for installation of board insulation materials; 38mm (1-1/2”) diameter, shaft length to suit insulation thickness and hot dipped galvanized fastener to suit substrate.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for board insulation application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Consultant.

3.2 INSTALLATION

.1 Install insulation after building substrate materials are dry.

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

.3 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.

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

.5 Do not enclose insulation until it has been inspected and approved by Consultant.

3.3 RIGID INSULATION INSTALLATION

.1 Apply adhesive to insulation board and substrate at rate of recommended by the manufacturer, by notched trowel.

.2 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.

.3 Leave insulation board joints un-bonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.4 PERIMETER FOUNDATION INSULATION

.1 Interior application: extend boards as indicated, vertically below bottom of finish floor slab, installed on inside face of perimeter foundation walls.

.2 Exterior application: extend boards to top of footing. Install on exterior face of perimeter foundation wall with adhesive.

.3 Under slab application: extend boards as indicated, in from perimeter foundation wall. Lay boards on level compacted fill.

3.5 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 21 13 – Board Insulation.

.3 Section 07 26 00 – Vapour Retarders.

.4 Section 09 21 16 – Gypsum Board Assemblies.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C553-13, Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C665-12, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.3 ASTM C1320-10, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.2 CSA Group

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

.2 CSA B149 PACKAGE-10, Consists of B149.1, Natural Gas and Propane Installation Code and B149.2, Propane Storage and Handling Code.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-2012, Standard for Mineral Fibre Insulation for Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Test Reports:

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

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 MATERIAL

.1 Mineral Fibre Batt Insulation:

.1 Unfaced, preformed mineral slag batt insulation in accordance with CAN/ULC S702-09, Type 1; having a nominal RSI of 0.67/25 mm; rated non-combustible in accordance with CAN/ULC S114-05 and having a flame spread rating of 5 or less in accordance with CAN/ULC S102; density 32 kg/m3; square edges, thickness as required to meet design insulation values indicated on drawings or as required to fill insulated spaces where not indicated, and as follows:

.2 Basis of Design Materials:

.1 Roxul Inc., Roxul Safe and Sound

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Install insulation with factory applied vapour barrier facing warm side of building spaces and vapour permeable membrane facing cold side. Lap ends and side flanges of membrane over framing members. Retain in position with staples installed as recommended by manufacturer. Tape seal butt ends and lapped side flanges. Do not tear or cut vapour barrier.

.3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.4 Do not compress insulation to fit into spaces.

.5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.6 Do not enclose insulation until it has been inspected and approved by Consultant.

3.3 CLEANING

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

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

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

.3 Waste Management: separate waste materials for recycling reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 21 16 – Blanket Insulation

.3 Section 07 25 00 – Weather Barrier

.4 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 QUALITY ASSURANCE

.1 Mock-Ups:

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.

.3 Mock-up will be used to judge quality of work, substrate preparation, and material application.

.4 Locate where directed.

.5 Allow 24 hours for inspection of mock-up by Consultant before proceeding with vapour barrier work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse by manufacturer and return of crates, padding, packaging materials pallets, in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 SHEET VAPOUR BARRIER

.1 Primary membrane vapour Barrier: Blueskin SA by HENRY or approved equal

.2 Polyethylene film: 10 mil. Poly minimum for under slab and transitions

2.2 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealants.

.3 Staples: minimum 6 mm leg stainless steel.

.4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

3 Execution

3.1 EXAMINATION

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

.2 Visually inspect substrate in presence of Consultant.

.3 Inform Consultant of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall, and ceiling, prior to installation of gypsum board to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.3 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.4 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.7 CLEANING

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

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

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

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Supply labour, materials, plant, tools and equipment to complete the Work as shown on the Drawings and as specified herein, including, but not limited to the following:

.1 Materials and installation methods of vapour permeable air barrier membrane system.

.2 Materials and installation methods to bridge and seal the following air leakage pathways and gaps:

.1 Connections of the walls to the roof air barrier. Connections of the walls to the foundations, seismic and expansion points, openings and penetrations of window frames, store front, and other envelope systems, door frames, piping, conduit, duct and similar penetrations, masonry ties, screws, bolts and similar penetrations. All other leakage pathways in the building envelope.

1.3 RELATED REQUIREMENTS

.1 Section 04 22 00: Masonry

.2 Section 07 21 13: Board Insulation

.3 Section 07 21 16: Blanket Insulation

.4 Section 07 92 00: Joint Sealants

.5 Section 08 11 00: Metal Doors and Frames

.6 Section 08 51 13: Aluminum Windows

.7 Section 09 21 16: Gypsum Wallboard

.8 Contractor shall be responsible for co-ordinating this section with all related sections.

1.4 PERFORMANCE REQUIREMENTS

.1 Provide a vapour permeable air barrier constructed to perform as a continuous air and vapour barrier, and as liquid water drainage plane flashed to discharge any incidental condensation or water penetration.

.2 The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space.

.3 The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:

.1 Foundations and walls.

.2 Walls and windows or doors.

.3 Different wall systems.

.4 Wall and roof.

.5 Wall and roof over unconditioned space.

.6 Walls, floor and roof across construction, control and expansion joints.

.7 Walls, floors and roof to utility, pipe and duct penetrations.

.8 All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

1.5 QUALITY ASSURANCE

.1 Work in this Section is to be carried out by a skilled applicator approved by manufacturer and in strict accordance with manufacturer's printed instructions. Upon request, provide written confirmation or certification from the vapour permeable air barrier manufacturer that the installer has been trained and is recognized by the manufacturer as suitable for the execution of the work.

.2 Perform Work in accordance with the manufacturer's written instructions of the air barrier membrane and this specification.

.3 Maintain one (1) copy of the manufacturer's written instructions on site.

.4 Compounds used in this section shall be sourced from one (1) manufacturer, including sheet membrane, air barrier sealants, primers, mastics and adhesives.

.5 Pre-Installation Conference:

.1 Convene a pre-installation conference two (2) weeks prior to commencing work of this section. Require attendance of parties directly affecting work of this section, including, but not limited to, the Owner’s representative, Consultant, General Contractor, vapour permeable air barrier membrane contractor, vapour permeable air barrier membrane manufacturer's representative and substrate installer.

.2 Contact Consultant two (2) weeks prior to pre-installation conference to confirm schedule.

.3 Review preparation and installation procedures and co-ordinating and scheduling required with related work.

.4 Record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to the vapour permeable air barrier membrane, including the following:

.1 Tour, inspect and discuss condition of substrate, penetrations and preparatory work performed by other trades.

.2 Review surface preparation, minimum curing period and installation procedures.

.3 Review special details and flashings.

.4 Review required submittals, both completed and yet to be completed.

.5 Review and finalize construction schedule related to work and verify availability of materials, installer’s personnel, equipment and facilities needed to make progress and avoid delays.

.6 Review required inspections, testing, protection and repair procedures.

.7 Review weather and forecasted weather conditions, and procedures for coping with unfavourable conditions.

.6 Arrange for a Manufacturer's Representative to:

.1 Visit the site and discuss any special requirements, procedures and unique conditions, prior to commencement of work.

.2 Inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 Periodically visit and inspect the installation and report unsatisfactory conditions to the Contractor.

.4 Attend final inspection and to submit written certification that the products, systems and assemblies have been installed in accordance with the manufacturer's requirements.

.7 Inspection and Testing:

.1 Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed vapour permeable air barrier membrane until any required inspections, testing approvals have been completed.

1.6 SUBMITTALS

.1 Submit submittals in accordance with the General Conditions and Section 01 33 00.

.2 Documentation:

.1 Prior to commencing the Work, submit documentation from an approved independent testing laboratory certifying that the air leakage and vapour permeance rates of the air barrier membranes, including primary membrane and transition sheets, exceed the requirements of the NBC.

.2 Prior to commencing the Work submit copies of manufacturer's current ISO certification. Membrane, primers, sealants, adhesives and associated auxiliary materials shall be included.

.3 Prior to commencing the Work submit references clearly indicating that the membrane manufacturer/installer has successfully completed projects on an annual basis of similar scope and nature for a minimum of fifteen (15) years. Submit references for a minimum of ten (10) projects.

.4 Prior to commencing the Work submit manufacturer's complete set of standard details for the air barrier membrane system showing a continuous plane of air tightness throughout the building envelope.

.5 Prior to commencing work provide a material checklist, complete with application rates and minimum thickness of primary membranes.

.3 Shop Drawings:

.1 Show the locations and extent of the vapour permeable air barrier system including details of typical conditions, intersections with other envelope systems and materials, membrane counter-flashings and details showing how gaps in construction will be bridged and how miscellaneous penetrations such as conduits, pipes, etc. are sealed.

.4 Samples:

.1 Submit to Consultant for approval, samples of materials and components to be used in vapour permeable air barrier system, prior to fabrication of work together with name of manufacturer and technical literature. Submit 305mm x 305mm (12" x 12") samples of vapour permeable air barrier membrane.

.5 Safety Data Sheets:

.1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on site for reference by workers.

1.7 ENVIRONMENTAL CONDITIONS

.1 Vapour permeable air barrier membrane is not to be applied to surfaces that are either wet, oily, frosted, dirty or contaminated in any way.

.2 Maintain surface of substrates and ambient temperatures constantly between 38 degree C and 5 degree C during application and curing of primers and adhesives for flexible vapour permeable air barrier membrane flashings, except as permitted otherwise by Consultant in writing.

1.8 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries with construction schedule and arrange for proper storage areas.

.2 Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

.3 Store materials in a clean, dry and protected area, off the floor or ground, in their original containers, sealed and undamaged. Manufacturer's labels are to be easily visible and undamaged. Store rolled materials on end.

.4 Store liquid membrane materials, adhesives and primers at minimum 5 degree C, and store away from open flames, sparks and excessive heat as liquid membrane materials and primers are flammable because of solvent content.

.5 Care and precaution are to be exercised by the applicator so as not to damage the work of other trades. Applicator is responsible to take all necessary precautions to protect work of other trades during application.

.6 In addition to the above, store modified bituminous sheet type flexible vapour permeable air barrier membrane flashings as follows;

.1 Store rolls of membrane tape in accordance with manufacturers written instructions.

.2 Store materials away from direct heat or open flame.

.3 Store rolls away from direct sunlight until ready for use.

.4 For installation in cold weather, store rolls of membrane in heated storage trailer for minimum of 24-hours with the temperature kept at 21 degree C and remove for application with as little exposure as possible to low ambient temperatures.

.7 The vapour permeable air barrier membrane is not designed for permanent exposure, but can be left exposed for up to a maximum of thirty (30) days. As soon as possible after the membrane has cured, protect vapour permeable air barrier membrane from damage by work of other Sections.

1.9 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of two (2) years and agree to repair and replace faulty materials or work which becomes evident during the warranty period, without cost to the Owner. Provide the Owner with a written warranty to this effect.

2 Products

2.1 MATERIALS

.1 Flexible Vapour Permeable Air Barrier Membrane:

.1 Type A or B may be used.

.2 Type A: Fluid applied, one component, elastomeric, water based, liquid polymer modified, asphaltic vapour permeable, membrane containing less than 100 g/l VOC.

.1 Basis of Design Product: AirBloc 31 by Henry Bakor, or approved alternates by Tremco or Carlisle Coatings and Waterproofing.

.3 Type B: Sheet-applied, self-adhering vapour permeable membrane bonded with permeable adhesive layer and split-back poly-release film.

.1 Basis of Design Product: Blueskin VP160 by Henry Bakor.

.2 Flexible Air Barrier Membrane Flashing Primer:

.1 Type A or Type B, as recommended by manufacturer to suit conditions.

.2 Type A: Solvent based, synthetic rubber adhesive type, quick setting, solvent based, roller consistency type primer.

.1 Basis of Design Product: Blueskin Primer by Henry Bakor Inc.

.3 Type B: Water based, polymer emulsion type.

.1 Basis of Design Product: Blueskin Aquaprime by Henry Bakor Inc.

.3 Flexible Air Barrier Membrane Flashings (Transition Flashings):

.1 40 mils (1mm) thick x width to suit, strips of self-adhering, SBS rubberized asphalt laminated to a cross-laminated, high density polyethylene film with a silconized release liner.

.1 Basis of Design Product: Blueskin TWF by Henry Bakor

.2 Supply additional flexible air barrier membrane flashings in sufficient quantities for steel lintels in masonry to Section 04 20 00, Masonry.

.4 Reinforcing Fabric (Joint Treatment Mesh):

.1 150mm (6") wide, open weave 20/10 mesh, glass fibre yarn saturated with synthetic resins, reinforcing fabric fabric weighing minimum of 2.5 oz/sq.yd., and conforming to CGSB 37-GP-63M

.1 Basis of Design Product: Yellow Jacket 990-06 by Henry Bakor

.5 Air Barrier Sealant:

.1 High solids, high flexibility, polymer modified, rubberized asphalt type sealant, compatible to vapour permeable air barrier membrane and conforming to CAN/CGSB-37.29-M.

.1 Basis of Design Product: Polybitume Sealing Compound by Henry Bakor

.6 Substrate Cleaners:

.1 Petroleum spirits thinner or low flash petroleum spirits (mineral spirits) conforming to CAN/CGSB-1.4-2000, or xylene thinner (xylol) conforming to CAN/CGSB-1.49-M.

.7 Packing Insulation:

.1 Loose, glass fibre or mineral fibre insulation, 1.0 lbs./cu.ft. density, and conforming to CAN/CGSB-51.11.

3 Execution

3.1 EXAMINATION

.1 The installer shall examine conditions of substrates, areas and other conditions under which the vapour permeable air barrier system will be applied for compliance with requirements.

.2 Verify that surfaces and conditions are ready to accept the Work of this section. Surfaces shall be sound, dry, even and free of oil, grease, dirt, excess mortar or other contaminants. Concrete surfaces shall be cured and dry, smooth without large voids, spalled areas or sharp protrusions. Masonry joints shall be flush and completely filled with mortar, and all excess mortar sitting on masonry ties shall have been removed. Verify substrate is visibly dry and free of moisture.

.3 Notify the Consultant in writing of any discrepancies. Commencement of work or any parts thereof shall mean acceptance of the prepared substrate.

.4 Do not proceed with application of vapour permeable air barrier membrane when rain is expected within 16-hours.

3.2 GENERAL

.1 Ensure continuity of the air seal throughout the scope of this section.

.2 Components and membrane materials must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.

.3 Install all materials in accordance with the manufacturer's written directions, unless otherwise specified herein.

3.3 SURFACE PREPARATION

.1 Clean, prepare and treat substrates according to manufacturer's written instructions. Surfaces to be coated must be smooth, clean, dry, firm to the touch and free from oil, grease, dirt, excess

mortar and other contaminants. Brushing and/or scraping of substrates may be required to adequately prepare surface. Thoroughly wash metal surfaces with mineral spirits or xylol and wipe dry with clean rags.

.2 Vapour permeable air barrier membrane is not to be applied over lightweight, cast-in-place concrete containing high moisture or certain curing compounds. Cast-in-place concrete should be cured for a minimum of two (2) weeks prior to application of vapour permeable air barrier membrane.

.3 Concrete surfaces shall be free of large voids and spalled areas. Fill all spalled concrete areas, form-tie holes/voids and open mortar joints in concrete block with mortar to produce a smooth, even surface. Allow to cure properly before proceeding.

3.4 JOINT AND PROTRUSION TREATMENTS

.1 Prepare only enough vapour permeable air barrier membrane compound as required for joint and protrusion treatments and can be used within compound's usable pot life. Mix vapour permeable air barrier membrane with a double blade agitator attached to a 13mm (1/2") drill in strict accordance with the manufacturer's written instructions.

.2 Exterior sheathing board inside/outside corners: Embed minimum 305mm (12") wide, continuous strip of reinforcing fabric in vapour permeable air barrier membrane, centred over corner.

.3 Fill joints up to 6mm (1/4") wide in exterior grade sheathing board and joints in between panels of exterior grade plywood with trowel application of vapour permeable membrane or mastic as recommended by manufacturer ensuring that joints are completely filled.

.4 Where joints in exterior grade sheathing board are over 6mm (1/4") wide, ensure joints are completely filled with a vapour permeable membrane or mastic and apply continuous flexible air barrier membrane flashing or mesh as specified herein, lapped a minimum of 75mm (3") and fully adhered to both sides of substrate.

.5 Where joints/cracks up to 6mm (1/4") wide occur in concrete or masonry, fill joints/cracks with a thick trowel application of vapour permeable air barrier membrane or mastic, ensuring that joints are completely filled.

.6 Where joints/cracks in concrete or masonry are over 6mm (1/4") wide, apply a vapour permeable membrane or mastic as recommended by manufacturer ensuring that joints are completely filled.

.7 Ensure continuity of air barrier membrane by working air barrier membrane over all exterior sheathing board fasteners and around all masonry ties and anchors and other items.

3.5 APPLICATION - FLEXIBLE AIR BARRIER MEMBRANE FLASHINGS

.1 Apply primer to all substrate areas where flexible air barrier membrane flashings are to be applied. Apply primer using lambs wool roller at rate 100 sq.ft. to 300 sq.ft./gallon (2.044 to 6.131 sq.m./gallon) depending on porosity of substrates. Allow primer to "tack up" for approximately 30-minutes prior to application of flexible air barrier membrane flashings.

.2 Do not use solvent-based primer where it may be in contact with polystyrene insulation.

.3 Install flexible air barrier membrane flashings in strict accordance with the manufacturer's written instructions unless otherwise specified herein.

.4 Ensure a uniform, continuous air barrier effect. Where air barrier membranes are to be provided under other Sections, co-ordinate the work such that air barrier membrane continuity is achieved.

.5 Provide air tight seals at penetrations in flexible air barrier membrane flashings.

.6 Apply flexible air barrier membrane flashings to extend air barrier membrane at peripheries of the installation as required to facilitate joining and sealing of the air barrier provided in adjacent construction, lapping joints minimum of 75mm (3"), extending membrane onto adjacent concrete/metal substrates not less than 150mm (6"), centred over joints.

.7 Apply continuous flexible air barrier membrane flashings at expansion and deflection joints within framing members, lapping joints minimum of 75mm (3"), extending membrane onto adjacent

concrete/metal substrates which have no applied air barrier not less than 150mm (6"), centred over joints.

.8 Flexible Weather Barriers:

.1 Provide continuous 457mm (18") side flexible weather barrier membrane in exterior masonry cavity walls at expansion joints.

.2 Install flexible weather barrier membrane to substrate with adhesive, in strict accordance with manufacturer's instructions.

.3 Loop down flexible weather barrier into expansion/control joints approximately two (2) times the width. Lap joints minimum 150mm (6") and seal. Ensure that flexible weather barrier lap joints which are looped into expansion /control joints are sealed with adhesive. Seal tops and bottoms of membrane barrier at change in construction to present continuous, uninterrupted flexible weather barrier.

.4 Pack joint with loose batt insulation with face of insulation down two (2) times the width of expansion from face interior wythe.

3.6 APPLICATION - VAPOUR PERMEABLE AIR BARRIER MEMBRANE - LIQUID APPLIED

.1 Areas to receive vapour permeable air barrier membrane are as follows:

.1 Behind metal siding (exterior face of exterior wallboard).

.2 Prepare only enough vapour permeable air barrier membrane compound as can be used within compound's usable pot life. Mix vapour permeable air barrier membrane with a double blade agitator attached to a 13mm (1/2") drill in strict accordance with the manufacturer's written instructions.

.3 Apply vapour permeable air barrier membrane to substrates in a continuous coating at a rate of 27 - 45 litres/9.29 sq.m. (6 to 10 gal./100 sq.ft.) by roller, spray or trowel methods, producing a minimum wet film thickness of 70 wet mils (1.5mm).

.4 Ensure that application of vapour permeable air barrier membrane overlaps all flexible air barrier membrane flashings, dampproof course/thru-wall flashings a minimum of 75mm (3").

.5 Where masonry anchors pass through the air barrier membrane, ensure continuity of air barrier by applying vapour permeable air barrier membrane all around/over masonry anchors.

.6 Prior to masonry being installed by Section 04 20 00, inspect vapour permeable air barrier membrane for punctures, voids, fishmouths and the like. Apply air barrier membrane sealant over damaged/affected areas, extending sealant minimum of 75mm (3") beyond damage in all directions.

3.7 APPLICATION - VAPOUR PERMEABLE AIR BARRIER MEMBRANE - SHEET APPLIED

.1 Apply self-adhering water resistive air barrier membrane complete and continuous to substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.

.1 Align and position self-adhering membrane to substrate, remove top panel of protective release film and press firmly into place.

.2 Ensure alignment, hold membrane in place to avoid wrinkles and sequentially remove remaining panels of protective film and press firmly into place.

.3 Ensure minimum 75mm (3") overlap at all end and 50mm (2") side laps of subsequent membrane applications.

.4 Apply pressure to all membrane surfaces, laps and flashings using an appropriate roller to provide best possible surface adhesion.

3.8 PROTECTION AND CLEAN-UP

.1 Protect membrane to avoid damage from other trades, and construction materials during subsequent operations.

.2 If the vapour permeable air barrier cannot be covered within thirty (30) days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins. Contact material manufacturer for further recommendations.

.3 Clean spillage and soiling on adjacent construction that will be exposed in the finished work using cleaning agents and procedures recommended by the manufacturer of the affected construction.

.4 Remove any masking materials after installation.

.5 Applicator is responsible for the removal of surplus and waste material incurred during application.

.6 Equipment and tools can be cleaned using mineral spirits or xylol.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of factory formed, site assembled, non-structural, concealed fastener, architectural metal roofing system; including accessories required for weather tight installation; job site manufactured materials will not be acceptable for this project.

.2 Drawings indicate size, profiles, and dimensional requirements of metal roofing system and are based on the specific system indicated; do not modify intended aesthetic effects.

1.2 RELATED REQUIREMENTS

.1 Section 07 21 00 Building Insulation and Vapour Barriers

.2 Section 07 62 00 Prefinished Metal Flashing and Trim.

.3 Section 07 71 36 Soffits, Gutters and Rainwater Goods

.4 Section 07 92 00 Joint Sealants

1.3 REFERENCE STANDARDS

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

.1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 Design of cladding system in accordance to the latest edition of:
-CSA-S136 for the design of Cold Formed Steel Structural Members
-Canadian Sheet Steel Building Institute Standards 10M and 20M.
-National Building Code of Canada

.3 ASTM A755/A755M-11, Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

.4 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

.2 Canadian General Standards Board (CGSB):

.1 CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing

.3 Canadian Standards Association (CSA):

.1 CSA A123.3-05 (R2010), Asphalt or Tar Saturated Roofing Felt

.2 CSA S136-07, North American Specification for the Design of Cold Formed Steel Structural Members

.4 Canadian Sheet Steel Building Institute (CSSBI):

.1 CSSBI 20M-99, Sheet Steel Cladding for Architectural, Industrial and Commercial Building Applications

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 00 – Project Meetings at project site with Contractor, Subcontractor and Consultant present before starting roof construction; purpose of meeting is to review methods and procedures related to roof construction and metal roofing system including; but not limited to, the following:

.1 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

.2 Review methods and procedures related to metal roofing system installation, including manufacturer's written instructions.

.3 Examine wood decking or sheathing conditions for compliance with requirements, including flatness and attachment to structural members.

.4 Review structural loading limitations of wood decking and sheathing during and after roofing.

.5 Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roofing system.

.6 Review temporary protection requirements for metal roofing system during and after installation.

.7 Review roof observation and repair procedures after metal roofing system installation.

.8 Inspection agency will document proceedings, including corrective measures and actions required, and furnish copy of record to each meeting participant.

.2 Coordination:

.1 Coordinate metal roofing system with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leak proof, secure, and non-corrosive installation.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittals.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data including; but not limited to, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roofing system and accessory.

.2 Shop Drawings: Submit shop drawings indicating fabrication and installation layouts of metal roofing system; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details, identify between factory and site assembled work, include details for the following:

.1 Flashing and trim

.2 Gutters

.3 Pre-finished metal vandal and dent resistant downspouts

.4 Roof curbs

.5 Snow guards

.3 Drawings shall be signed and sealed by a Professional Engineer licenced in the province of Ontario, attesting to the ability of the metal panels assembly to withstand the specified loads.

.4 Samples: Submit two (2) samples for each type of exposed finish required for Consultant’s and Owner’s verification of finishes, full size physical samples required.

.5 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Coordination Drawings: Coordination drawings indicating locations of penetrations and roof mounted items including; but not limited to, the following:

.1 Roof systems and attachments.

.2 Pipe supports and penetrations

.3 Lighting fixtures

.4 Snow guards

.5 Items mounted on roof curbs

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturers written maintenance data for metal roofing system, include name of original installer and contact information for inclusion in maintenance manuals in accordance with Section 01 77 19 Close-Out Requirements.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturer: Obtain each type of metal roofing system through one source from a single manufacturer.

.2 Installer: Use only installers that are trained and qualified by factory formed roofing panel manufacturer, and who have experience in projects of similar complexity and scope.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver components, metal roofing system, and other manufactured items to prevent damage or deformation; package metal roofing system for protection during transportation and handling.

.2 Storage and Handling Requirements: Unload, store, and erect metal roofing system in a manner to prevent bending, warping, twisting, and surface damage, and as follows:

.1 Protect metal roofing system to prevent wetting of materials, and as follows:

.1 Stack metal roofing system on platforms or pallets, covered with suitable weather tight and ventilated covering.

.2 Do not store metal roofing system in contact with other materials that might cause staining, denting, or other surface damage.

.2 Protect strippable protective covering on metal roofing system from exposure to sunlight and high humidity, except to extent necessary for period of metal roofing system installation.

.3 Protect foam plastic insulation from surface degradation, and as follows:

.1 Do not expose to sunlight, except to extent necessary for period of installation and concealment.

.2 Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

.3 Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 SITE CONDITIONS

.1 Site Measurements: Verify locations of roof framing and roof opening dimensions by site measurements before metal roofing system fabrication and indicate measurements on shop drawings.

.2 Established Dimensions: Establish framing and opening dimensions and proceed with fabricating metal roofing system without site measurements where site measurements cannot be made without delaying the Work, or allow for site trimming of panels; coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

.3 Ambient Conditions: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roofing system in accordance with manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

.1 Provide manufacturer's standard form of warranty stating that manufacturer agrees to repair or replace components of metal roofing system that fail in materials or workmanship within specified warranty period; failures will be considered to include; but are not limited to, the following:

.1 Structural failures, including rupturing, cracking, or puncturing.

.2 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

.3 Deterioration of finishes, peeling or cracking of coating, failure to adhere to bare metal, colour fading and chalking.

.2 Warranty Period:

.1 Finishes: Forty (40) years from date of Substantial Performance.

.2 Weather Tightness: Forty (40) years from date of Substantial Performance stating that manufacturer agrees to repair or replace metal roofing system failing to remain weather tight; including leaks, within specified warranty period.

.3 Vicwest TRADITION150: {WeatherX™ (Siliconized Polyester - SMP) will not crack, chip, or peel (lose adhesion) for forty (40) years from date of installation (40.5 yrs from application). This does not include minute fracturing that may occur during the normal fabrication process. WeatherX™ (Siliconized Polyester - SMP) will not chalk in excess of a number six (6) rating, in accordance with ASTM D-4214-98 method D659 at any time for thirty (30) years from date of installation (30.5 yrs from application); will not change colour more than eight (8.0) Hunter ΔE units as determined by ASTM method D-2244-02.}

2 Products

2.1 MANUFACTURERS

.1 Basis of Design and approve roofing system

.1 Vicwest Steel Inc. – Tradition150: System 3000 or approved equal

2.2 PERFORMANCE REQUIREMENTS

.1 Design and construct roof so that completed installation will not leak.

.2 Structural Design Performance:

.1 Design Roof System to Resist:

.1 Maximum deflection not to exceed l/180 under system's own weight plus wind load (positive and negative) loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:50 years.

.2 Design the systems so that there is no air or water infiltration under the positive and negative forces imposed by wind and gravity loads. Provide means of draining space between insulation and exterior skin, in accord with NRC Rain Screen Principles.

.2 Thermal movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

.1 Temperature change (range): 20 deg C, ambient; 40 deg C, material surfaces.

2.3 METAL ROOFING SYSTEM

.1 Roof System: Tradition150-4: System 3000 by Vicwest.

.2 Panel Materials: Coated steel sheet with coil coating having galvanized finish using hot dip process and pre-coated using coil coating process in accordance with ASTM A755M, and as follows:

.1 Galvanized Steel Sheet: ASTM A653 structural quality Grade 230 or 340, having Z275 coating designation.

.2 Profile:

.1 Low sloped roof application, seamed joint at 610mm (24") complete with seams a minimum of 50mm (2") above the bottom of the ribbed profile.

.2 Basis of Design Material: Profile TRADITION150 System 1000 by Vicwest.

.3 Finish: Prefinished colour selected from manufacturer’s standard or premium range using Valspar WeatherX or Baycoat 10000 Series.

.3 Air/Vapour Barrier: Membrane shall be sopraseal stick 1100t by soprema inc. or approved equal

.4 Sealants: In accordance with manufacturer's recommendation and Section 07 92 00.

.5 Clip and Subgirt System:

.1 Thermally responsive clips to be fabricated from a minimum of 0.61 mm (0.018") steel, with minimum Z275 galvanized coating designed to accommodate expansion and contraction of the roof sheet.

.2 Continuous hat bar and zee clips made from galvanized material, thickness to suit design parameters, to accommodate depth of insulation.

.3 Roof Fasteners: As specified by manufacturer , to resist wind uplift and sliding snow forces.

.6 Prefinished Roof Sheet, exposed to exterior.

.1 Profile: Tradition 150-4, with T-style ribs at 400 mm spacing.

.2 Panel: Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 having a nominal core thickness 0.61mm (0.024”).

.7 Snap Cap:

.1 Seam Caps: Provide seam caps for full length of the roof panel with sealant of non-skinning, non-drying sealant on the unexposed side. Caps to be mechanically seamed onto panel side-laps. Fabricated from Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 having a nominal core thickness 0.61mm (0.024”). Finish and colour to match roof sheet.

2.4 FABRICATION

.1 Fabricate and finish metal roofing system and accessories at the factory to greatest extent possible, using manufacturer's standard procedures and processes to obtain the indicated profiles and meeting dimensional and structural requirements for the Project.

2.5 FINISHES, GENERAL

.1 Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

.2 Variations in appearance of abutting or adjacent pieces are acceptable if they are within ½ the range of reviewed samples:

.1 Noticeable variations in the same piece are not acceptable.

.2 Variations in appearance of other components are acceptable if they are within the range of reviewed samples and are assembled or installed to minimize contrast.

3 Execution

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roofing system supports, and other conditions affecting performance of work.

.2 Examine primary and secondary roof framing to verify that angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roofing system manufacturer.

.3 Examine roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roofing system manufacturer.

.4 Examine roughing-in for components and systems penetrating metal roofing system to verify actual locations of penetrations relative to seam locations of metal roofing system before metal roofing system installation.

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

3.2 PREPARATION

.1 Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

.2 Install auxiliary levelling substrate boards over metal deck; attach with mechanical fasteners into top flutes of steel to prevent wind uplift.

.3 Install flashings and other sheet metal in accordance with requirements specified in Section 07 62 00.

.4 Install eave angles, furring, and other miscellaneous roof system support members and anchorage in accordance with metal roofing system manufacturer's written recommendations.

3.3 INSTALLATION

.1 Air/Vapour Barrier:

.1 Install self adhering sheet ice and water shield, wrinkle free, on roof sheathing.

.2 Apply primer if required by manufacturer and install in accordance with temperature restrictions of ice and water shield manufacturer; use primer rather than nails for installing ice and water shield at low temperatures.

.3 Apply over entire roof in shingle fashion to shed water, with end laps of not less than 150mm (6”) staggered 610mm (24") between courses and as follows:

.1 Overlap side edges not less than 89mm (3-1/2").

.2 Extend ice and water shield into gutter trough.

.3 Roll laps with roller.

.4 Cover ice and water shield within 14 days.

.4 Install flashings to cover ice and water shield in accordance with requirements specified in Section 07 62 00.

.2 Thermal Insulation: Extend insulation in thickness indicated to cover entire roof in accordance with manufacturer’s installation requirements.

.3 Metal Roofing System:

.1 Install metal roofing system in accordance with manufacturer’s written instructions.

.2 Install exterior prefinished roof panels on panel support clips, using manufacturer's proper construction procedure. Ensure batten is positively locked for full length of roof.

Close interlocking side joints by using a purpose-made seaming machine, as supplied by the manufacturer.

.3 Where indicated on approved shop drawings, secure the end-lap of metal roofing sheets in accordance with the manufacturer's specifications and details to provide a weather-tight seal. Exposed fasteners to match colour of the roof sheet.

.4 Provide notched and formed closures, sealed against weather penetration, at changes in pitch, and at ridges and eaves, where required.

.5 Use concealed fasteners when possible. Exposed fasteners to match colour of roof sheet.

.6 Lock all end joints and install gaskets, joint fillers, and sealants where required for weatherproof performance of metal roofing system; include types of gaskets, fillers, and sealants recommended by metal roofing system manufacturer.

.7 Use stainless steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

.8 Protect against galvanic action where dissimilar metals contact each other or corrosive substrates, by painting contact surfaces with bituminous coating, by applying rubberized asphalt ice and water shield to each contact surface, or by other permanent separation as recommended by metal roofing system manufacturer.

.9 Provide metal soffit panels full width of soffits and install panels perpendicular to support framing; flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.4 ACCESSORY INSTALLATION

.1 Install accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

.2 Install components required for a complete metal roofing system assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

.3 Install flashing and trim in accordance with performance requirements, manufacturer's written installation instructions, and SMACNA recommendations; provide concealed fasteners where possible, and set units true to line and level; install work with laps, joints, and seams that will be permanently watertight and weather resistant.

.4 Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

.5 Provide for thermal expansion of exposed flashing and trim:

.1 Space movement joints at equally spaced intervals to a maximum of 3050mm (10') feet on centre with no joints allowed within 610mm (24") of corner or intersection.

.2 Form expansion joints of intermeshing hooked flanges, not less than 25mm (1") deep, filled with mastic sealant concealed within joints where lapped or bayonet type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof.

.6 Provide seamless continuous gutter:

.1 Attach gutters to eave with gutter hangers spaced not more than 1220mm (48") on centre using manufacturer's standard fasteners.

.2 Provide end closures and seal watertight with sealant.

.3 Provide for thermal expansion.

.7 Provide seamless continuous downspout sections with telescoping joints:

.1 Provide fasteners designed to hold downspouts securely 25mm (1”) away from walls.

.2 Locate fasteners at top and bottom and at approximately 1524mm (5') on centre between top and bottom fasteners.

.3 Provide dent and vandal resistant elbows at base of downspouts to direct water away from building.

.8 Install roof curbs at locations indicated on Drawings; install flashing around bases where they meet metal roofing system.

.9 Attach snow guards to metal roofing system as recommended by snow guard manufacturer; do not use fasteners that will penetrate metal roofing system.

.10 Form flashing around pipe penetration and metal roofing system; fasten and seal to metal roofing system as recommended by manufacturer.

3.5 ERECTION TOLERANCES

.1 Shim and align metal roofing system units within installed tolerance of 6mm (1/4") in 6m (20') on slope and location lines as indicated and within 3mm (1/8") offset of adjoining faces and of alignment of matching profiles.

3.6 SITE QUALITY CONTROL

.1 Engage a factory authorized service representative to inspect completed metal roofing system installation, including accessories and to report results in writing to Owner and Consultant.

.2 Remove and replace applications of metal roofing system where inspections indicate that they do not comply with specified requirements.

.3 Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

.1 Remove temporary protective coverings and strippable films, if any, as metal roofing system are installed, unless otherwise indicated in manufacturer's written installation instructions.

.2 Clean finished surfaces as recommended by metal roofing system manufacturer upon completion of metal roofing system installation; maintain in a clean condition during remainder of construction.

.1 Replace metal roofing system components that become damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 21 16 – Blanket Insulation

.3 Section 07 26 00 – Vapour Retarders

.4 Section 07 92 00 – Joint Sealants

.5 Section 08 11 00 – Metal Doors and Frames

.6 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A135.6-06, Hardboard Siding Standard.

.2 ASTM International

.1 ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.4 CSA International

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

.2 CSA O121-08, Douglas Fir Plywood.

.3 CSA O151-09, Canadian Softwood Plywood.

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

.5 Environmental Choice Program (ECP)

.1 CCD-045-95, Sealants and Caulking Compounds.

.6 National Lumber Grading Authority (NLGA)

.1 NLGA Standard Grading Rules for Canadian Lumber 2010.

.7 Sustainable Forestry Initiative (SFI)

.1 SFI-2010-2014 Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures. Indicate VOC's for caulking materials during application and curing.

.3 Shop Drawings:

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

.4 Samples:

.1 Submit duplicate 305 x 305 mm size profile specified.

1.4 QUALITY ASSURANCE

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

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

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.1 Storage and Handling Requirements:

.2 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.3 Store and protect wood siding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 MATERIALS

.1 Hardboard siding:

.1 Approved Manufacturer: Maibec or equal and approved.

.2 Finish: Textured and brushed-face, pre-finished.

.3 Dimensions: 150mm (6”).

.4 Fastening: Concealed fastening.

.5 Colour: As selected by Departmental Representative.

.6 Installation: Vertical.

.2 Accessories: exposed trim, closures, cap pieces of manufacturer's standard; Finish: To match siding colour, as approved by the Departmental Representative.

.3 Fascia and Soffit:

.1 To match timber framing complete with vee joint groove, as approved by the Departmental Representative.

.4 Fasteners: nails to CSA B111, hot galvanized steel, sized as required, spiral type with flat head.

.5 Staples: As recommended by the Siding Manufacturer.

.6 Sealants: As indicated in Section 07 92 00.

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install siding to manufacturers' written instructions.

.2 Install sill flashings, wood starter strips, inside corner flashings, edgings and flashings over openings.

.3 Fasten wood siding in straight, aligned lengths to furring using two nails or approved staples at each fixing location. Intermediate butt joints are not permitted. Stagger butt joints not less than 800 mm and distribute evenly over wall faces. Cut butt joints at 45 degrees. Seal cut surfaces.

.4 Fasten plywood siding so that edges are supported. Maintain 1.5 mm wide gap between sheets. Nail at 300 mm on centre along intermediate supports and 150 mm along edges. Caulk vertical joints.

.5 Fasten fascia and soffit, as indicated on drawings to provide a complete installation. Nail at 300 mm on centre along intermediate supports and 150 mm along edges.

3.4 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by wood siding installation.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of an elastomeric membrane roofing system including, but not limited to, the following:

.1 Fully adhered membrane roofing system

.2 Membrane installation accessories, anchors, adhesives and sealants

.3 Roof insulation

.4 Vapour retarder

.5 Gypsum auxiliary levelling board on steel roof deck.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 07 21 00 - Building Insulation and Vapour Barrier

.3 Section 07 27 39 - Vapour Permeable Air Barrier Membranes.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim.

.5 Section 07 92 00 - Joint Sealants

1.3 REFERENCE STANDARDS

.1 Canadian Roofing Contractors' Association (CRCA):

.1 Roofing Specification Manual

.2 National Roofing Contractors' Association (NRCA):

.1 Quality Control Recommendations for EPDM Roofing

.3 American National Standards Institute (ANSI):

.1 ANSI/SPRI RP-4-1997 Wind Design Standard For Ballasted Single-Ply Roofing Systems

.4 American Society for Testing of Materials (ASTM):

.1 ASTM C1002-07, Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

.2 ASTM C1396/C1396M-11, Standard Specification for Gypsum Board

.3 ASTM D448-08, Standard Classification for Sizes of Aggregate for Road and Bridge Construction

.4 ASTM D4263-83(2012) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

.5 ASTM D4637/D4637M-12, Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane

.6 ASTM D6369-99(2006) Standard Guide for Design of Standard Flashing Details for EPDM Roof Membranes

.7 ASTM D6383/D6383M-99(2011)e1 Standard Practice for Time-to-Failure (Creep-Rupture) of Adhesive Joints Fabricated from EPDM Roof Membrane Material

.5 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 37-GP-52M-05, Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric

.6 Canadian Standards Association (CSA):

.1 CAN/CSA A123.21-04, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems

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

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 00 - Project Meetings, attended by roofing manufacturer's representative, roofing contractor's representative, roofing inspector, the Contractor, Consultant and Owner to review installation conditions particular to this project and s follows:

.1 Review materials specified in this section and identify any coordination or installation issues affecting construction.

.2 Review methods and procedures related to roofing installation, including manufacturer's written instructions.

.3 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

.4 Examine deck substrate conditions and finishes for compliance with manufacturer's requirements including flatness and fastening.

.5 Review structural loading limitations of roof deck during and after roofing.

.6 Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

.7 Review governing regulations and requirements for insurance and certificates if applicable.

.8 Review temporary protection requirements for roofing system during and after installation.

.9 Review roof observation and repair procedures after roofing installation.

.10 Consultant will complete minutes and prepare report for this meeting.

.2 Co-ordination: Co-ordinate compatibility of materials: provide materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience; roofing materials must be compatible with air barrier and vapour retarder.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 - Submittals.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit of manufacturer's technical data sheets describing materials' physical properties, explanations about product installation including installation techniques, restrictions, limitations and other manufacturer recommendations.

.2 Shop Drawings: Submit membrane manufacturer's standard details being used for this project, indicate changes made to make details project specific; include sloped insulation manufacturer's proposed roofing diagrams and layouts for review by the Consultant.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Declaration of Material Compatibility: Provide a written declaration to the Consultant that roofing materials and components are compatible with wall air and vapour retarder membranes.

.2 Certificates: Submit installer certificates signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Provide roof maintenance information in accordance with Section 01 33 00 - Submittals: Operations and Maintenance Data.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform roofing and sheet metal work in conformance with the roofing manufacturer's written recommendations using materials; submit proof that roofing materials meet required performance when requested by the Consultant.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturer: Obtain roofing membrane materials through one source from a single manufacturer or using materials from a secondary source that are acceptable to the manufacturer.

.2 Installer: Use an installation company that is a member in good standing of the Canadian Roofing Contractors Association (CRCA), using workers who are trained and approved by the roofing membrane manufacturer; maintain a full time experienced journeyman roofer, and at least one apprentice per crew on the Work at all times.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver roofing materials to site packaged in original containers with seals unbroken and labelled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

.2 Storage and Handling Requirements: Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck and as follows:

.1 Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

.2 Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources; store in a dry location in accordance with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.9 SITE CONDITIONS

.1 Ambient Conditions: Proceed with installation only when existing and forecasted weather conditions permit roofing system installation in accordance with manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

.1 Manufacturer Warranty: Product manufacturer shall issue a written and signed warranty in the owner's name, certifying product performance properties for a period of Thirty (30) years, starting from the date of acceptance, covering wholly and completely the specified warranty period starting from Substantial Performance of the entire Contract.

2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Carlisle SynTec Incorporated

.2 Firestone Building Products Company

2.2 PERFORMANCE REQUIREMENTS

.1 Compatibility: Verify that roofing materials are provided by the same manufacturer or are compatible with one another when provided by different manufacturers and as follows:

.1 Roofing materials must be compatible with air and vapour retarder membranes.

.2 Provide a written declaration to the Consultant that roofing materials and components are compatible with wall air and vapour retarder membranes.

.2 Provide a membrane roofing system that has been tested successfully, and that resists corner, perimeter and field-of-roof uplift pressure criteria established by SPRI Wind Load Design Guide, using Building Code 1/50 year wind pressures for location of installation.

2.3 MATERIALS

.1 Auxiliary Levelling Surface: Glass mat faced, mould resistant roof sheathing boards having a treated gypsum core manufactured in accordance with ASTM C1177, and as follows:

.1 Thickness: As indicated

.2 Long Edges: Square.

.3 Location: Roof substrates over sheathing.

.4 Acceptable Materials:

.1 CGC Securock Glass-Mat Sheathing

.2 Georgia Pacific DensDeck

.2 Adhesives:

.1 Membrane Roofing Materials Adhesive: Manufacturer's recommended materials compatible with specified roofing products.

.2 Insulation Adhesive: Manufacturers recommended adhesives specifically formulated for installation of plastic insulation to roofing materials and meeting accepted products status for specified Warranty Certificate.

.3 Gypsum Board Adhesive: Manufacturers recommended adhesives specifically formulated for installation of gypsum board to metal deck.

.3 Vapour Retarder: Pre-manufactured modified bituminous, self adhering vapour retarder, designed specifically for installation to dry steel decks; width 55” and having a non-slip surface and UV resistant opaque surface:

.1 Acceptable Materials:

.4 Bakor Vapor-Bloc SA

.1 IKO Modified Vapour Protector

.2 Soprema Sopravap'R

.5 Insulation:

.1 Sloped Insulation: Polyisocyanurate foam rigid board roof insulation as described above, sloped to a minimum 1% perpendicular from edge of roof to a minimum thickness of 1” to achieve a minimum total insulation thickness of 3” when combined with primary flat insulation at drain locations.

.2 Membrane Underlayment:

.1 As per written instruction from manufacturer.

.3 Fasteners:

.1 As per written instruction from manufacturer.

.4 Elastomeric Membrane: Flexible ethylene propylene diene monomer (EPDM) sheet membrane meeting requirements of ASTM D4637/D4637M-12 or CAN/CGSB 37-GP-52M and as follows:

.1 Type I, non-reinforced

.2 Thickness: nominal 90 mils

.3 Exposed Face Colour: Black

.4 Basis-of-Design Materials: EPDM Membrane by Firestone Building Products.

2.4 ACCESSORIES

.1 Auxiliary Materials: As recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

.2 Sheet Metal Flashing: Refer to Section 07 62 00.

.3 Membrane Flashing: Nominal 0.06” thick EPDM, partially cured or cured, according to application and manufacturer's standard details.

.4 Preformed Cant Strips and Tapered Edge Strips: Laminated, high density fibre reinforced board with perlite insulation, asphalt impregnated, approximately 4” x 4” x 1-1/2” thick, and as follows:

.1 Basis-of-Design Materials: Johns Manville, FesCant Plus Cant Strip and Tapered Fesco Edge Strip

.5 Bonding Adhesive: Manufacturer's standard bonding adhesive.

.6 Seaming Material: Manufacturer's standard synthetic rubber polymer primer and minimum 3” wide butyl splice tape with release film.

.7 Water Cut-off Mastic: Manufacturer's standard butyl mastic sealant.

.8 Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1” x 1/8” with manufacturer recommend anchors.

.9 Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories required for a complete roofing system in accordance with manufacturer's requirements for specified roof system.

.10 Aggregate Ballast: aggregate ballast in accordance with CGSB 8.2 or ASTM D448-08 of the following type and size:

.1 Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth faced stone.

.2 Size: Ranging in size from 19 mm (3/4”) to 38 mm (1-1/2”).

.3 Concrete Pavers: High density hydraulic pressed pavers, nominal 24” x 24” weight not exceeding 45 kg per unit, standard grey.

.11 Pedestals: High density polyethylene formed into an 8 X 8 grid like structure with integral spacer ribs on upper surface and shims for proper level alignment.

.1 Basis-of-Design Materials: Envirospec, Inc., Pave-EL

.12 Mechanical and Electrical Supports and Flashings: Provide mechanical and electrical device supports and flashings, compatible with roofing membrane, as recommended by roofing specialty manufacturer.

.1 Basis-of-Design manufacturer: Thaler Metal industries Ltd.

3 Execution

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions for compliance with the following requirements and other conditions affecting performance of roofing system:

.1 Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

.2 Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

.3 Verify that roof drains, curbs, penetration pockets, and similar details including mechanical and electrical items are located a minimum of 3' from perimeters.

.4 Verify that surface plane flatness and fastening of steel roof deck complies with Structural Engineer's requirements.

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

3.2 PREPARATION

.1 Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

.2 Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof drain plugs when no work is taking place or when rain is forecast.

.3 Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSTALLATION

.1 Conform to Roofing Specifications as published by Canadian Roofing Contractors Association (CRCA) as a reference.

.2 Auxiliary Levelling Surface: Adhere gypsum board levelling surface into the upper rib surfaces of sheathing at a minimum rate of one (1) fastener per 0.25 m^2, 12 screws and washers for each 4'x 8' board and following:

.1 Increase rate to one (1) fastener per 0.20 m^2, 15 screws and washers for each 4' x 8' board, for a distance of 8' around perimeter of the roof and 45 deg across the corners at a distance of 10' from the corner of the building.

.2 Cut boards so edges rest on centre of upper ribs. Cut straight lines with adequate tools.

.3 Cut boards cleanly where slopes change directions; avoid breaking boards to acquire deck form.

.4 Place boards perpendicular to deck ribs for continuous support at extremities.

.5 Stagger board joints in half lengths, tightly butted.

.3 Vapour Retarder Installation:

.1 Install pre-manufactured membrane vapour retarder in accordance with manufacturer's written instructions.

.2 Install roof vapour retarder to meet and overlap air and vapour retarder membrane from adjoining walls to ensure total continuity.

.3 Install vapour retarder membrane at insulation perimeters and around each element piercing the insulation to ensure sealed connections with base sheet at up stands.

.4 Installation of sloped Insulation: Install membrane underlayment in accordance with manufacturer's written requirements, and as follows:

.1 Firmly set the insulation overlay boards, long joints continuous and short joints staggered. Boards must be evenly and tightly butted together, with joints offset from primary insulation joints.

.2 Apply only as many boards as can be covered by roofing membrane in the same day.

.5 Full adhered Roofing Membrane Installation: Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing, and as follows:

.1 Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

.2 Accurately align roofing membranes, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

.3 Adhere perimeter, corners and transitions of roofing membrane according to requirements in ANSI/SPRI RP-4 as follows:

.1 Design termination attachment to withstand 150 kg/m loading.

.2 Adhere membrane to substrate as per written instruction from manufacturer.

.4 Apply roofing membrane with side laps shingled with slope of deck where possible.

.5 Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

.6 Leave seams uncovered until inspected by roofing inspector.

.7 Repair tears, voids, and lapped seams in roofing that does not meet requirements.

.8 Install protection mat over roofing membrane, overlapping a minimum of 6”; install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12”.

.6 Base Flashing Installation: Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions and as follows:

.1 Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

.2 Flash penetrations and field formed inside and outside corners with cured or uncured sheet flashing.

.3 Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

.4 Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.4 SITE QUALITY CONTROL

.1 Inspection and Testing of roofing installation will be undertaken roof by technical representative from roofing manufacturer.

.2 Inspection fees will be paid by the owner in accordance with Section 01 45 00 – Quality Assurance.

.3 Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Consultant.

.4 Notify Consultant or Owner 48 hours in advance of date and time of inspection.

.5 Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.5 PROTECTING AND CLEANING

.1 Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Consultant and Owner.

.2 Correct deficiencies in, or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Performance and according to warranty requirements.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 - Masonry

.2 Section 07 41 13 - Metal Roof Panels

.3 Section 07 46 23 - Wood Siding

1.2 REFERENCES

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

.1 ASTM A167-99(2004), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A240/A240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

.4 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM A792/A792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.6 ASTM B32-04, Standard Specification for Solder Metal.

.7 ASTM B370-03, Standard Specification for Copper Sheet and Strip for Building Construction.

.8 ASTM D523-89(1999), Standard Test Method for Specular Gloss.

.9 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.4 Canadian Standards Association (CSA International)

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

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

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.4 Samples:

.1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

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

.2 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative Departmental Representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied polyvinylidene fluoride.

.1 Class F1S.

.2 Colour: As selected by Departmental Representative from manufacturer's standard range.

.3 Specular gloss: 30 units +/- in accordance with ASTM D523.

.4 Coating thickness: not less than 22 micrometres.

.5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period 5000 hours.

.2 Humidity resistance exposure period 5000 hours.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.1 Maximum VOC limit 50 g/L.

.3 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.4 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Solder: to ASTM B32.

.7 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.

.8 Touch-up paint: as recommended by prefinished material manufacturer.

.1 Maximum VOC limit 150 g/L.

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 AAI-Aluminum Sheet Metal Work in Building Construction.

.3 Form pieces in 2400 mm maximum lengths.

.1 Make allowance for expansion at joints.

.4 Hem exposed edges on underside 12 mm.

.1 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, and copings to profiles indicated of 24 gauge thick prefinished steel.

2.5 EAVES TROUGHS AND DOWNPIPES

.1 Form eaves troughs and downpipes from prefinished steel to match flashing and trim.

.2 Sizes and profiles as indicated.

.3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Use concealed fastenings except where approved before installation.

.2 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using standing seams forming tight fit over hook strips, as detailed.

.3 Lock end joints and caulk with sealant.

.4 Turn top edge of flashing into cap flashing minimum of 25 mm. Lead wedge flashing securely into joint.

.5 Caulk flashing at cap flashing with sealant.

.6 Install pans, where shown around items projecting through roof membrane.

3.3 EAVES TROUGHS AND DOWNPIPES

.1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough spikes through spacer ferrules.

.1 Slope eaves troughs to downpipes as indicated.

.2 Seal joints watertight.

.2 Install downpipes and provide goosenecks back to wall.

.1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

.3 Install splash pans as indicated.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 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.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

.2 Description of Work:

.1 Supply and install all prefinished metal soffits, fascias, gutters and rainwater goods as indicated on the drawings and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 04 20 00: Masonry

.2 Section 05 50 00: Metals Fabrications

.3 Section 06 10 00: Rough Carpentry

.4 Section 07 62 00: Sheet Metal Flashing and Trim

.5 Section 07 92 00: Joint Sealants

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturer and tradesmen executing the work of this section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Erection of metal soffits, gutters and rainwater goods shall be by workers especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this section at all times.

1.4 SUBMITTALS

.1 Submit submittals in accordance with the General Conditions and Section 01 33 00.

.2 Shop Drawings:

.1 Submit fully dimensional shop drawings to Consultant showing construction, assembly, elevations, sections and interfacing with work of other sections.

.2 No work of this section shall be fabricated until shop drawings and all other related submittals, documentation, certifications and samples as required by this section, have been reviewed by the Consultant.

.3 Details shall indicate metal thicknesses, areas to be sealed and sealant materials, gaskets, type of joints, flashings, trim, finishes, fasteners and all anchorage assemblies and components and erection details.

.3 Samples:

.1 Submit to the Consultant for approval, samples of materials and components to be used in the system, prior to fabrication of work together with name of manufacturer and technical literature. Submit 300mm x 300mm samples of prefinished metal.

1.5 DESIGN REQUIREMENTS

.1 Design gutters and rainwater goods to contain volume rainwater coming off sloped roof areas in compliance with the requirements of the local Building Code and the requirements of all authorities having jurisdiction.

.2 Design total systems, confirm adequacy of design, proper provision for and use of all proprietary materials and components from other suppliers forming part of the work of this section.

.3 Co-ordination:

.1 Co-ordinate the work of this section with related trades to ensure best quality installation.

1.6 WORKMANSHIP

.1 Joints and intersecting members shall be accurately fitted, in true planes, square, plumb, straight, true with tight joints and intersections. Provide adequate reinforcing, anchorage and fastenings.

.2 Execute the work of this section in accordance with the recognized highest standards of workmanship of the industry.

.3 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, scratches, dents and abrasion.

.4 Thickness of metal shall be adequate for various conditions and to ensure dent and vandal resistance.

.5 Isolate where necessary to prevent electrolysis due to dissimilar metal to metal contact or metal to masonry or concrete. Use bituminous paint or other approved divorcing membrane.

.6 Ensure proper use of proprietary materials in strict accordance with the material manufacturer's directions.

1.7 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage locations. Do not load any area beyond the design limits.

.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather.

.3 Assembled units and/or their component parts shall be transported, handled and stored in a manner to preclude damage. Accessory materials required for erection at the site shall be delivered to the site in manufacturer's labelled containers. Remove all units or components which are cracked, bent, chipped, scratched or otherwise unsuitable for installation and replace with new.

.4 Provide safe and adequate equipment on the Site to execute the work of this section, hoisting, scaffolding, staging, safety protection equipment, tools, plant and other equipment required for the completion of the work of this section.

.5 Delivered damaged materials or materials which do not comply with this section shall be rejected by Consultant, removed from the Site and replaced with acceptable materials at Contractor's expense.

.6 Adequately protect the structure and work of all other trades during delivery, storage, handling and erection of the work of this section.

.7 Components being hoisted to the working level shall be adequately banded and carefully slung employing steel wire rope.

.8 Bundles shall be tag lined during the ascent of the hoisting operation. Precaution shall be taken to avoid damage to metal components and to prevent marring of exposed surfaces.

.9 Metal components, after being positioned, shall be adequately secured in place as quickly as possible and prior to leaving the job site at the end of the working day.

.10 Loose bundles of metal components shall be adequately secured at the completion of each working day.

.11 Scaffolds, platforms, ladders, and the like, required by the erector for installation of metal components shall be properly secured to prevent accidental movement or collapse.

2 Products

2.1 MATERIALS

.1 Steel / Aluminum:

.1 Sheet metal conforming to ASTM A653/A653M-11, structural quality, Grade 'A' with a minimized spangle zinc coating of Z275 conforming to ASTM A653/A653M-11, shall be used for preformed metal soffits, trims, fascias, gutters, rainwater goods and flashings.

.2 Preformed metal shall be minimum 22 gauge required base steel nominal thickness or thicker, to meet design requirements.

.3 Metal fascias and flashings shall be minimum 22 gauge required base steel nominal thickness or thicker, to meet design requirements.

.4 Metal gutters and rainwater goods shall be heavy duty thick gauge to ensure they are dent and vandal resistant to meet design requirements

.5 Preformed metal fascia, gutters, rainwater goods and metal flashings shall be prefinished coil coated material in accordance with Technical Bulletin No. 7 "Prefinished and Post Painted Galvanized Sheet Steel for Exterior Building Products" of the Canadian Sheet Steel Building Institute. (CSSBI), in CSSBI 5,000 Series finish and in colours as later selected by Consultant from manufacturer's full available colour range including extended colour range.

.6 Flatstock Material:

.1 Minimum thickness to suit design requirements, coil coated sheet steel, prefinished to CSSBI 5,000 Series requirements. Colour shall be as selected later by Consultant.

.2 Soffit Vent Strip:

.1 Continuous Stainless steel linear soffit vent strip, installed within wood soffit as shown on the drawings. Fabricated from minimum 20. gauge stainless sheet steel, having multiple row vent slots which provide minimum vented area.

.2 Colour: Brushed stainless steel finish.

.3 Roofing Cement:

.1 Cut back asphalt plastic cement conforming to CAN/CGSB-37.5

.4 Lap Cement:

.1 Fibrated cut back asphalt plastic cement conforming to CAN/CGSB-37.4

.5 Bituminous Paint:

.1 Conforming to CAN/CGSB-1.108

.6 Nails and Spikes:

.1 Galvanized steel nails and spikes of sufficient length and conforming to CSA B111, Table 12.

.7 Sealant:

.1 Multi-component, chemical curing epoxidized polyurethane conforming to CAN/CGSB-19.24, 'Dymeric 240' by Tremco (Canada) Ltd. Colour as selected later by Consultant.

.2 Primers: As recommended by sealant manufacturer to suit applicable conditions.

.8 Recessed Reglets:

.1 Preformed 0.70mm prefinished galvanized steel channel with face and ends covered with plastic tape.

.9 Eavestrough Brackets:

.1 3mm x 38mm prefinished galvanized steel straps.

.10 Eavestrough Spacers:

.1 2mm x 38mm prefinished galvanized steel straps.

.11 Eavestrough Anchors:

.1 10mm diameter x 150mm long galvanized lag screws and ferrules.

.12 Field Touch-Up Paint:

.1 Zinc rich anti-corrosion primer, conforming to CAN/CGSB-1.181, 'Galvafroid, Grade SB' by W.R. Meadows of Canada Limited and top coating of type and colour to match finish sheet.

2.2 FABRICATION

.1 Form metal rake and eave edge flashings from 0.55mm thick prefinished galvanized steel.

.2 Form curb metal flashings from 0.55mm thick prefinished galvanized steel.

.3 Form eavestroughs and downspouts from prepainted galvanized sheet steel. Form eavestroughs of 100mm widths using continuous rolling process. Downspouts shall be corrugated type for ogee profile eavestroughs and rectangular box type for rectangular profile eavestroughs. Eavestroughs of different profiles and girths shall require different metal thicknesses as follows:

Rectangular Profile	Girth Thickness	Nominal Size
100mm	510mm	.55mm
150mm	530mm to 635mm	.70mm

.4 Fabricate all flashings components to maximum length of 2400mm.

.5 Form rake edge flashing with 100mm wide deck flange and minimum 100mm deep fascia flange with 15mm x 45E doubled drip edge.

.6 Form eave edge flashing with 100mm wide deck flange and minimum 100mm deep fascia flange.

.7 Overbrake rake and eave flashings slightly so that when installed, fascia flashings are sprung tightly to fascia boards or wall fascia panels.

.8 Form flashing and counterflashing for penetrations from 0.70mm thick prefinished galvanized sheet steel.

3 Execution

3.1 EXAMINATION AND PREPARATION

.1 Inspect areas of the Work over which the work of this section is dependent for any irregularities detrimental to the application and performance of the work of this section.

.2 Notify Consultant in writing of all conditions which are at variance with those in the Contract Documents and/or detrimental to the proper and timely installation of the work of this section. The decision regarding corrective measures shall be obtained from the Departmental Represenatative/Consultant prior to proceeding with the affected work of this section.

.3 Coordinate work of this section with work of other sections.

.4 Commencement of work of this section implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Join all prefinished steel components with sealant and cadmium plated screws.

.2 Lap flashing joints 50mm and seal both sections along lap with sealant. Nail joints securely.

.3 Backpaint sheet metal with bituminous paint.

.4 Where reglet detail is indicated or required, insert metal flashing into reglet to form tight fit. Seal flashing into reglet with sealant.

.5 Set edge flashing on deck along rake and eave edges.

.6 Nail deck flange to deck with two rows of annular ringed nails. Set one row 25mm from fascia board with nails at 200mm O.C. Set second row 25mm from cut edge of metal with nails at 400mm O.C., staggered with first row.

.7 Secure 100mm wide eavestroughs to building with galvanized lag screws through spacer sleeves at 750mm O.C.

.8 Secure eavestroughs over 100mm wide with brackets at 750mm O.C. Install spacer bars at 750mm O.C. Stagger position of brackets and spacer bars.

.9 Slope eavestroughs to downspouts.

.10 Install continuous eaves troughs. Close ends of each length. Install to each section at least one downspout.

.11 Install "ells" and "tees" as required, and secure downspouts to wall with pre-painted galvanized heavy duty sheet steel straps at 1500mm O.C., minimum 2 straps per downspout.

.12 Install prefinished wood soffit panels complete with all edge trims level to within 3mm in 2400mm.

.13 Install continuous, stainless steel linear soffit vents as indicated on the drawings to provide ventilation of concealed spaces in accordance with NBC requirements.

3.3 CLEAN UP AND REPAIRS

.1 Clean and make good to the Consultant's approval, 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, without additional cost the Owner.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply and install materials in accordance with published 'Through-Penetration Firestop Systems' in UL's Fire Resistance Directory or the publication of another approved independent laboratory.

1.2 RELATED REQUIREMENTS

.1 Section 04 20 00: Masonry

.2 Section 07 81 29: Applied Fireproofing

.3 Section 07 92 00: Sealants

.4 Section 09 21 16: Gypsum Wallboard

.5 Section 09 21 19: Gypsum Board Shaft Wall Assemblies

.6 Contractor shall be responsible for coordinating this section with all related sections.

1.3 REFERENCE STANDARDS

.1 Underwriters Laboratories of Canada (ULC):

.1 CAN/ULC S115-05, Standard Method of Fire Tests and Firestop Systems

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

.1 ASTM E814-11a, Standard Test Method for Fire Tests of Penetration Firestop Systems

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Provide details indicating all reinforcing, anchorages, fastening and proposed method of installation for the various conditions within the project.

.3 Samples:

.1 Submit samples of each type of firestop and smokeseal material and accessory.

1.5 QUALITY ASSURANCE

.1 Applicator shall be licensed by the manufacturer of fireproofing materials.

.2 Conform to flame and temperature ratings established by ULC CAN4-S115-05 and ASTM E814-11a.

.3 Submit manufacturer's certification that materials meet or exceed specified requirements.

.4 Maintain flame and temperature ratings equal to surrounding materials.

1.6 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Deliver materials in original, unopened packages bearing name of manufacturer and product identification.

.2 Store materials off ground, under cover, and away from damp surfaces.

1.7 SITE CONDITIONS

.1 Do not apply materials when temperature of substrate material is below 4 deg.C and surrounding air temperature is below 4 deg C, for 24 hours prior to application.

2 Products

2.1 MATERIALS

.1 Bears UL, ULC or Warnock Hersey label and confirmation of compliance with ASTM E814-11a or CAN4-S115.

.2 Provide fire stopping and smoke sealing systems in accordance with CAN4-S115-M and shall also conform to special requirements in part 3.5 of the Building Code.

.3 Fire-resistant rating of fire stopping material assemblies must meet or exceed the fire-resistance rating of the floor or wall section being penetrated.

.4 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control shall be elastomeric seal type. Do not use a cementitious, or rigid seal at such locations.

.5 Primers shall be to manufacturer's recommendation for specific material, substrate, and end use.

.6 Damming and backup materials, supports and anchoring devices shall be to manufacturer's recommendations, and in strict accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.7 Sealants for vertical joints, shall be non-sagging type.

3 Execution

3.1 PROTECTION

.1 Mask adjacent work of other Sections as necessary to avoid spillage onto adjoining surfaces. Remove stains on adjacent surfaces as required.

3.2 PREPARATION

.1 Examine sizes and conditions to establish correct thickness and installation of backup materials. Ensure surfaces are dry and frost free.

.2 Clean bonding surfaces of deleterious substances including dust, paint, rust, oil, grease and other foreign matter which may otherwise impair effective bonding.

.3 Do not apply firestops and smokeseals to surfaces previously painted or 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 Prepare surfaces in accordance with manufacturer's instructions.

.5 Priming and Sealing: Prime surfaces in accordance with manufacturer's instructions.

3.3 APPLICATION

.1 Mix materials in accordance with manufacturers' written instructions.

.2 Apply in strict accordance with ULC certification and manufacturer's recommendations to provide a temperature and flame rated seal equal as a minimum to the rating of the wall or floor surrounding.

.3 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

.4 Seal all joints to ensure an air and water resistant seal, capable to withstand compression due to thermal, wind or seismic joint movement.

.5 Consult with Mechanical Engineer and project manager prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

.6 Apply to mechanical and electrical service through-penetrations, to formed, sleeved, or cored openings in smoke and fire rated masonry, or gypsum wallboard stud walls and structural floors and ceilings.

.1 Coordinate with plumbing, HVAC and electrical contractors to ensure proper firestopping application, providing smokeseal around penetrations through fire rated assemblies. Ensure that end joints between lengths of firestopping material have been properly sealed.

.7 Apply to head of smoke and fire rated gypsum wallboard stud wall abutting underside of structure (concrete or steel deck).

.8 Apply to control joints in rated stud walls.

.9 Apply to penetrations for passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire rated vertical barriers (walls and partitions), horizontal beams (floor/ceiling assemblies) and vertical service shaft walls and partitions.

.10 Apply to slots or gaps between edge of floor slabs and curtain walls.

.11 Apply to openings between structurally separate sections of walls and floors.

.12 Apply to gaps between tops of walls and ceiling or roof assemblies.

.13 Apply to expansion joints in fire rated walls and floors.

.14 Apply to openings and penetrations in fire rated partitions or walls containing fire doors.

.15 Apply to openings around structural members which penetrate fire rated floors or walls.

.16 Apply firestop and smokeseal materials in accordance with manufacturer's directions, with sufficient pressure to properly fill and seal openings.

.17 Tool or trowel exposed surfaces.

.18 Remove excess compounds promptly as work of this Section progresses and upon completion of work of this Section.

3.4 CURING

.1 Cure materials in accordance with manufacturer's instructions.

.2 Do not cover up materials until proper curing has taken place.

3.5 IDENTIFICATION

.1 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, prepreinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

.1 The words: "Warning: Through-Penetration Firestop System - Do Not Disturb"

.2 Contractor's name, address and telephone number.

.3 Designation of applicable testing and inspection agency.

.4 Date of installation.

.5 Manufacturer's name for firestop materials.

3.6 CLEAN UP AND REPAIRS

.1 Clean adjacent surfaces immediately and leave work neat and clean.

.2 Remove excess materials using recommended procedures, as work progresses.

.3 Remove dams after initial set of firestops and smokeseals as required.

.4 Correct staining and discolouring of adjacent surfaces as directed by Consultant.

.5 Remove all debris and excess materials entirely from the site and leave the work in a neat and tidy condition.

.6 Perform one simulated smoke test for each penetration type once per day. Simulate smoke at a rate of four seconds/100 cubic feet (2.8 cubic metres) and maintain the fog density until inspection is complete.

.7 After inspection is complete, repair all defective firestopping and smokeseals and test again. Continue this procedure until all firestopping and smokeseals passes test.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 46 23 – Wood Siding

.2 Section 07 62 00 – Sheet Metal Flashing and Trim

.3 Section 08 11 00 – Metal Doors and Frames

.4 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 ASTM International

.1 ASTM C919-08, 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 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.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 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Samples:

.1 Submit 2 samples of each type of material and colour.

.2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after 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 Health Canada.

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 off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Sealant Type "A" – Joints around Interior Door Frames, Windows and Under Exterior Thresholds:

.1 One-part, low or medium modulus, neutral curing 100% silicone joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 35.

.2 Sealant Type "B" – Expansion / Control Joints:

.1 One-part, ultra low modulus, non-staining neutral curing 100% silicone joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 50.

.3 Sealant Type "E" – Mould and Mildew Resistant:

.1 Mould and mildew resistant, Shore A Hardness 15 25, conforming to ASTM C920-11, Type S, Grade NS, Class25, use NT, G, and A:

.4 Sealant Type "F" – Glazing Joints:

.1 Silicone Sealant: Butt glazing, one part, moisture curing, shore A hardness 15 25, conforming to CAN/CGSB 19.13 M, Classification C 1 40 B N and C 1 25 B N and ASTM C920-11, Type S, Grade NS, Class 25, use NT, G, A, O; Colour: clear (translucent):

.5 Sealant Type "G" – Exterior Wall Joints:

.1 Air seal sealant: One part, silicone, shore A hardness 15-25, conforming to CGSB 19 GP 13M, classification C 1 40 B N and C 1 25 B N and ASTM C920-11, Type S, Grade NS, Class 25. Use NT, M, G, A and O:

.6 Sealant Type "H" – Saw Cut Sealant:

.1 Multi component, self levelling, conforming to ASTM D2240-05(2010):

.7 Preformed Compression Seal:

.1 Compartmental open cell neoprene extrusion type conforming to ASTM C509-06(2011), complete with liquid lubricant adhesive recommended by manufacturer.

2.3 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 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.

3.7 CLEANING

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

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

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

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

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.8 PROTECTION

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

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 08 11 00 – Metal Doors and Frames

.2 Section 08 71 00 – Door Hardware

.3 Section 08 80 50 – Glazing

1.2 REFERENCES

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

.1 ASTM A653/A653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

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

.2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-99, Standard for Fire Doors and Fire Windows.

.2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.

.5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 for ratings specified or indicated.

.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, and listed by nationally recognized agency having factory inspection services.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

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

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, 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, fire rating, 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.

.4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

.3 Cast or rolled pure sheet lead: to ASTM B29, thickness 16 gauge.

2.2 DOOR CORE MATERIALS

.1 Door Core Construction:

.2 Interior Door: Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m3 minimum sanded to required thickness.

.3 Exterior Door: Rigid extruded, closed cell insulation, fire retardant treated meeting the requirements of ULC S701-11, Type 4, minimum thermal resistance R-Value 4.5/1” thickness.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Adhesive: maximum VOC content 50 g/L.

.3 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.4 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 09 91 00 - Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 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.

.3 Door bottom seal: As indicated in Section 08 71 00.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal rivited.

.6 Glazing: As indicated in Section 08 80 50.

.7 Make provisions for glazing as indicated and provide necessary glazing stops.

.1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.

.2 Design exterior glazing stops to be tamperproof.

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: 16 gauge welded type construction.

.4 Interior frames: 1.2mm welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, 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 on centre 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, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: honeycomb hollow steel construction. Interior doors: honeycomb hollow steel 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, gasketting and hardware in accordance with ASTM E330.

.5 Blank, reinforce, drill doors and tap for mortised, templated hardware 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 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 face sheets for exterior doors from 1.6mm sheet steel with polystyrene core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.2mm sheet steel with honeycomb core laminated under pressure to face sheets.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floorand thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor, and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 1 apply to work of this Section.

1.2 REFERENCES

.1 ASTM A123 - Standard specification for Zinc (hot-dipped galvanized) coating on iron and steel products.

.2 ASTM A229 - Standard specification for Steel wire, oil-tempered for mechanical springs.

.3 ASTM A653 - Standard specification for Steel sheet, zinc-coated (galvanized) by the hot-dipped process, commercial quality.

.4 ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.5 ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

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

1.3 SYSTEM DESCRIPTION

.1 Wind Loads: Completed work shall withstand positive and negative wind pressure loads normal to plane required by the governing building code.

1.4 QUALITY ASSURANCE

.1 Installer: Trained and approved by the manufacturer and having a minimum three years experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type. If requested, provide letter of certification from manufacturer stating that installer is certified applicator of its products, and is familiar with proper procedures and installation requirements required by the manufacturer.

.2 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper maintenance procedures.

.3 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.4 Manufacturer’s Site Inspection: Have the manufacturer’s technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. When requested, submit manufacturer’s inspection reports and verification that the work of this Section is correctly installed.

1.5 SUBMITTALS

.1 Product Data: Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Details of construction and fabrication.

.4 Installation methods.

.2 Shop Drawings: Indicate each type of coiling doors, arrangement of hardware, operating mechanism and required clearances.

.3 Maintenance Data: Provide operation and maintenance data for coiling doors for incorporation into Maintenance Manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

.2 Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

.3 Store materials in a dry, warm, ventilated weathertight location.

1.7 COORDINATION

.1 Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

2 Products

2.1 COILING METAL COUNTER DOORS

.1 Basis of Design Material: ESC20 Rolling Counter Door by Cornell Cookson, or accepted equivalent, as approved by the Consultant.

.2 Curtains:

.1 Material: Flat faced, 2”, No. 17 slats fabricated of stainless steel 20 gauge.

.2 Alternate slats will be fitted with end locks to hold curtain in alignment.

.3 Bottom of curtain finished with an extruded, tubular, or single angle bottom bar fitted with a continuous vinyl bumper to protect counter top.

.3 Guides: Extruded aluminum. Continuous strips of wool pile are inserted into guides to eliminate metal-to-metal contact and to provide dust-seal around curtain.

.4 Brackets: Metal plates with permanently sealed ball bearings designed to enclose ends of coil and provide support for counterbalance pipe at each end. Plated fabricated of stainless steel 3/16” thick minimum.

.5 Counterbalance: Curtain is coiled on a pipe of sufficient size to carry door load with a deflection not to exceed 0.033 inch per foot of door span and to be correctly balanced by helical springs, oil tempered torsion type. Cast iron barrel plugs are used to anchor springs to tension shaft and pipe.

.6 Hood: Hood will enclose curtain coil and counterbalance mechanism and is fabricated of sheet metal, flanged at top for attachment to header and flanged at bottom to provided longitudinal stiffness.

.1 Stainless steel minimum 24-gauge.

.7 Locking

.1 Curtain to be locked at each end of bottom bar by concealed slide bolts which engage in a developed slot in each guide.

.2 Provide cylinder lock at jambs or in center of bottom bar.

.8 Mounting: Overhead Structure with: Steel jambs.

2.2 OPERATION - MANUAL

.1 Equip doors for manual operation with crank operator and removable hand crank.

2.3 STAINLESS-STEEL FINISHES

.1 General: Remove or blend stretch lines and tool and die marks into finish. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

.2 Bright, Directional Polish: No. 4 finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

3 Execution

3.1 EXAMINATION

.1 Verify opening sizes, tolerances and conditions are acceptable.

.2 Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

.3 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install work in accordance with manufacturers' printed instructions.

.2 Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

.3 Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

.4 Fit and align assembly including hardware; level and plumb, to provide smooth operation.

.5 Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.

.6 Install perimeter trim and closures.

.7 Replace damage work with new work in matching finish and colour.

3.4 ADJUSTING

.1 Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

.2 Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

.1 Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

.2 Remove labels and visible markings.

3.6 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of the following:

.1 Exterior overhead insulated sectional doors;

.2 Operating hardware and tracks;

.3 Electric Operator.

1.2 RELATED REQUIREMENTS

.1 Section 04 20 00: Masonry

.2 Section 05 50 00: Miscellaneous Metals

.3 Section 06 10 00: Rough Carpentry

.4 Section 09 21 16: Gypsum Wallboard

.5 Section 09 90 00: Painting

1.3 REFERENCE STANDARDS

.1 ASTM A123/A123M-11 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-11 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 CSA-C22.1-12 - Canadian Electrical Code, Part I (22th Edition), Safety Standard for Electrical Installations.

.4 CAN/CSA-C22.2 No. 100-04 (R2009) - Motors and Generators.

.5 NEMA MG1-2011 - Motors and Generators..

1.4 SYSTEM DESCRIPTION

.1 Panels: Insulated steel, plain - no ribs; with full view insulated glazed sections.

.2 Lift Type: Standard lift, High-lift and Low-headroom lift operating style, where indicated on the Drawings, complete with track and hardware.

.3 Operation: Electric.

.4 Design sectional overhead doors to operate at 1 kPa wind pressure, without any detrimental effects.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Submit shop and erection drawings in accordance with General Conditions.

.2 Show and describe in detail special door assemblies, including elevations, sections and detail of doors, track, hardware and operating components, and of relationship of door to adjacent construction including dimensions, gauges, thickness, description of materials, finishes, as well as all other pertinent data and information.

.3 Samples for Initial Selection: Submit manufacturer's colour charts showing full range of colours available for units with factory applied finishes for initial selection.

.4 Operating and Maintenance Data:

.1 Provide operating and maintenance data for incorporation into the Operating and Maintenance Manual.

1.6 QUALITY ASSURANCE

.1 Regulatory Agencies: Provide laboratory tested products acceptable to the Authority Having Jurisdiction for the following criteria:

.1 Electrical: Provide electrical components, devices and accessories, motors, controls and wiring conforming to CSA Standards and CSA labelled.

.2 Qualifications:

.1 Work shall be executed by a firm having minimum five (5) years' experience in successful manufacture and installation of work of type and quality shown and specified.

.3 Job Conditions:

.1 Protect during installation any adjacent finished surfaces from contamination and damage due to work under this section.

1.7 STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

1.8 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where sectional overhead doors are required to fit within openings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating sectional overhead doors without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

1.9 WARRANTY

.1 Provide five (5) year manufacturer's warranty for degradation of finish, including cracking, rust through or delamination.

.2 Provide five (5) year manufacturer's warranty for electric operating equipment.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar section overhead insulated metal doors may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Design based on Moderno by GARAGA or approved alternate:

.1 Owner to choose from any profile or colour during shop drawing review

2.2 MATERIALS

.1 Sheet Steel: ASTM A653/A653M galvanized to Z180 (G60), stucco embossed surface; pre-coated with silicone polyester finish.

.2 Aluminum Extrusions: ASTM B221M (ASTM B221), 6063-T6 alloy and temper.

.3 Glazing Panels: Acrylic; Colour: Clear.

.4 Insulation: Foam-type polyurethane core; nominal RSI-3.2 (R-18) thermal value.

2.3 PANEL CONSTRUCTION

.1 Panels: Steel construction; outer steel sheet of 0.46 mm (26 gauge) thickness, flush - no ribs profile; inner steel sheet of 0.46 mm (26 gauge) thickness, flush - no ribs profile; continuous sheet steel reinforcement strips, 32 mm (1-1/4”) wide by 0.91 mm (20 gauge) thick mounted top and bottom for hinge mounting, tongue and groove weather joints at meeting rails; insulated.

.2 Door Thickness: Nominal 50 mm (2”) thick.

.3 Full View Glazing Sections: Acrylic, double insulating sealed units with extruded aluminum frame, set in place with removable moulding; as shown on Drawings, overall thickness 13 mm (1/2 inch).

2.4 DOOR HARDWARE COMPONENTS

.1 Track:

.1 Rolled steel with corrosion resistant powder coat finish, 1.9 mm (14 gauge) base metal thickness mounted to continuous one-piece powder coated angle, minimum 1.9 mm (14 gauge) thickness.

.2 Track size 75 mm (3”) with maximum 380 mm (15”) track radius.

.2 Hinge and Roller Assemblies:

.1 Heavy duty powder coated hinges and adjustable roller holders.

.2 Rollers: 75 mm (3”) floating bearing less Nystroll nylon rollers with stainless steel shaft, located at top and bottom of each panel, each side.

.3 Bottom Bracket: Powder coated steel, minimum 2.66 mm (12 gauge) thick with removable aluminum roller holder.

.3 Lift Mechanism: Galvanized torsion springs fitted on zinc-plated 25 mm (1”) continuous hollow tube shaft/coupler, 1.9 mm (14 gauge) thickness, keyed and mounted on ball bearings, and supported by heavy gauge galvanized gusset plates; oil tempered with 10,000 standard cyclage.

.4 Cable Drums: Suitable for lift type specified, with stainless steel aircraft grade lifting cables designed to suit door weight at a safety factor of 5:1.

.5 Fasteners: Stainless steel.

2.5 ACCESSORIES

.1 Sill Weatherstripping: Low temperature resilient vinyl astragal, one-piece; fitted to retainer at bottom of door panel, full length contact.

.2 Jamb Weatherstripping: Roll formed end stile section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

.3 Head Weatherstripping: Low temperature, one-piece full length top retainer/seal.

.4 Panel Joint Weatherstripping: Bulb-type, one-piece full length resilient weatherseal.

2.6 DOOR OPERATOR

.1 Door Operator Type: Basic chain type manual operation.

.2 Provide contacts for intrusion alarm coordinate with electrical.

2.7 FINISHES

.1 Exterior Surfaces: Pre-coated; Colour: As selected by the Consultant from the manufacturers premium product line.

.2 Interior Surfaces: Pre-coated; Colour: As selected by the Consultant from the manufacturers premium product line.

3 Execution

3.1 EXAMINATION

.1 Examine all areas of Work that affect the work of this section. Report in writing all errors, defects and discrepancies immediately to the Consultant.

.2 Commencement of work of this section implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Install door unit assembly to manufacturer's written instructions.

.2 Anchor assembly to wall construction and building framing without distortion or stress.

.3 Securely brace door tracks suspended from structure. Secure tracks to structural members only.

.4 Fit and align door assembly including hardware.

.5 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.

.6 Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

.7 Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.

.8 Install perimeter trim and closures.

3.3 ERECTION TOLERANCES

.1 Maximum Variation from Plumb: 1.5 mm (1/16”).

.2 Maximum Variation from Level: 1.5 mm (1/16”).

.3 Longitudinal or Diagonal Warp: Plus or minus 3 mm (1/8”), from 3 m (10’) straight edge.

.4 Maintain dimensional tolerances and alignment with adjacent work.

3.4 ADJUSTMENT AND DEMONSTRATION

.1 Upon completion of work of this section, and when directed by the Consultant, adjust and lubricate sectional overhead doors, check and adjust controls, ensure that all equipment and mechanisms are operating smoothly, and demonstrate the operation, control and safety features of each door to the Consultant and the Owner.

3.5 CLEANING AND CLEAN-UP

.1 Clean and make good to the Consultant's approval, surfaces soiled or otherwise damaged in connection with the work of this section. Contractor shall pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.

.2 On completion of the work of this section, remove all debris, equipment and excess material from the site that results from the work of this section.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 50 00 - Metal Fabrications

.2 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

.1 Review and comply with NBC:

.1 Section 9.7 Windows

.2 Subsection 9.7.2 Window Standards

.3 Subsection 9.7.3 Glass

These minimum material and performance standards shall apply as if written here.

.2 CAN/CGSB-12.8-M Insulating Glass Units.

.3 CAN/CGSB-12.10-M Glass, Light and Heat Reflecting.

.4 Hardware and glazing shall meet requirements of jurisdictional authorities.

.5 Test Reports: Submit CMHC Evaluation Report, certifying compliance with specifications for:

.1 Windows: Classifications CAN/CSA-A440

.2 Material: Aluminum

.3 Screens: Insect to CGSB 79-GP-1M

.4 Air Leakage: A3 to ASTM E-283-91

.5 Water Leakage: B5

.6 Wind Load Resistance: C3

.7 Temperature Index: I56.7/63.3 with Low E glass

1.3 SUBMITTALS

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

.2 Submit extended guarantee for insulating glass units installed in windows.

.3 Provide operation and maintenance data for windows into manual specified in Section 01 78 00 – Closeout Submittals.

2 Products

2.1 MATERIALS

.1 Materials to conform to CAN A440-M supplemented as follows:

.1 All windows by same manufacturer.

.2 Sash: aluminum profiles thermally broken.

.3 Aluminum Alloy: to CAN/CSA-A440, including Appendix B, finish to be prefinished colour from manufacturer's standard range to be selected by Architect at later date.

.4 Main frame: aluminum, thermally broken.

.5 Fasteners: stainless steel, type 303 to ASTM E-149.

.6 Thermal break; cork-neoprene composition or extruded rigid polyvinyl chloride.

.7 Sill: modest aluminum sill made of same material as window to be provided by window manufacturer. See details.

.2 Window Classification: CAN3 A440-M90.

Air infiltration of exterior windows must not exceed 7.75 x 10-4/s for each metre of sash crack when tested at a different pressure of 75pa.

.1 Air leakage: A3 to ASTM E-283-91

.2 Water leakage: B5

.3 Wind load resistance: C3

.4 Condensation resistance: minimum of 47.8lg = 70, If = 69

.3 Glazing:

.1 Insulating glass units: to CAN2-12.8-M with rear pane clear float glass, and front pane tempered. 6mm thick for each lite.

.2 Refer to 2.1.2.4 above for translucent requirements.

.4 Insect Screens: to CGSB 79-GP-1M-76

.1 Type: 2

.2 Class: A

.3 Style: 1

.4 Insect screening mesh: count 18 x 16 fibreglass

.5 Fasteners: spline

.6 Screen frames: Aluminum enameled frame to match window frame.

.7 Secure to interior of frame with manufacturer's standard latches coloured to match frames.

.5 Fabricate windows generally to dimensions indicated on drawings to meet specified requirements, and all requirements of CMHC and in accordance with CAN/CSA A440-M supplemented as follows:

.1 Fabricate units square and true with maximum tolerance of plus or minus

.2 1.5mm for units with a diagonal measurement of 1800mm or less and plus or minus 3mm for units with a diagonal measurement over 1800mm.

.6 Brace frames to maintain squareness and rigidity during shipment and installation.

.7 Finish exposed surfaces of aluminum components with enamel coating in accordance with CAN/CSA A440, including Appendix C. Colour to be selected from manufacturer's standard finishes.

.8 Hardware:

.1 Generally: manufacturer's standard operating and locking hardware. Enamelled finish on exposed hardware.

.9 Weatherstrip:

.1 To meet requirements of Evaluation Report for:

.1 Air Leakage: A3

.2 Water Leakage: B5

3 Execution

3.1 ERECTION

.1 Install in accordance with CAN/CSA A440 Appendix A and to details.

.2 Install windows plumb, level, anchored to structure and with no structural load imposed at heads.

.3 Adjust operating members and hardware to work smoothly without binding and to fit tightly when closed and locked. Lubricate where operation requires it.

.4 Caulk at all jambs, sills and heads, interior and exterior, to provide an airtight joint as specified in Section 07 92 00. Use non-expanding EPS and polyethylene rope filler between rough openings and frames. Caulk around both outside and inside of all window/door end wall joints.

.5 Anchor window/skylights to adjacent construction on all sides using manufacturer specified approved anchors.

.6 Provide for levelling and continuous support of sills.

.7 Examine construction at site and take critical dimensions to ensure that window sizes, anchorage and means of adjustment provide for required support and clearances.

END OF SECTION

1 General

1.1 SUMMARY

.1 Install all door hardware listed in the Door Hardware Schedule, prepared by the Architectural Hardware Consultant.

.2 The supply of the door hardware will be covered under a cash allowance; refer to Specification Section 01 21 00.

1.2 RELATED REQUIREMENTS

.1 Section 08 11 00 - Metal Doors and Frames.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Submission of Substitutions: Materials other than the named products for the Project may be acceptable to the Consultant. Submit manufacturer's names and complete catalogue number of alternative hardware types proposed for supply and submit this list for review before preparing shop drawings.

.2 Consultant will review all proposed alternates prior to close of bids when submitted no later than five (5) days prior to bid closing date

.3 Substitutions for materials of this section will be considered after the close of bids.

.4 Pre-installation Conference: Arrange a preconstruction meeting in accordance with Section 01 31 19 - Project Meetings to discuss the following:

.1 Keying Conference: Conduct keying conference at Project site and incorporate decisions into final keying schedule after reviewing door hardware keying system.

.2 Electrified Hardware Conference: Conduct pre-installation conference at Project site and review methods and procedures related to electrified door hardware.

.5 Coordination: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Coordinate with shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware.

1.4 SUBMITTALS

.1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with the General Conditions and Section 01 33 00 Submittals.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data indicating installation details, material descriptions, dimensions of individual components and profiles, and finishes.

.2 Shop Drawings: Submit shop drawings indicating details of electrified door hardware including, but not limited to, the following:

.1 Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and site installed wiring.

.3 Samples:

.1 Submit samples of complete line of hardware and finishes, if and when requested, to accompany any proposal for substitution. Fully label each sample as to manufacture, type, size and location for use proposed.

.4 Hardware Schedule: Submit door hardware schedule prepared by, detailing fabrication and assembly of door hardware.

.3 Do not order hardware from manufacturers until samples have been approved. Hardware and finishes supplied shall be identical with approved samples.

.1 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

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

.5 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

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

1.6 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:

.1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Tools:

.1 Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

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

1.8 DELIVERY, STORAGE AND HANDLING

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

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

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:

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

.2 Store and protect door hardware from nicks, scratches, and blemishes.

.3 Protect prefinished surfaces with wrapping.

.4 Replace defective or damaged materials with new.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's for similar products where possible.

.2 All hardware and accessories to be stainless steel and exterior grade.

2.2 DOOR HARDWARE

.1 **Locks and latches:**

.1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2, series 2000 preassembled lock, grade 1, designed for function and keyed as stated in Hardware Schedule.

.2 Interconnected locks and latches: to ANSI/BHMA A156.12, series 5000 interconnected lock, grade 2, designed for function and keyed as stated in Hardware Schedule.

.3 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 2, designed for function and keyed as stated in Hardware Schedule.

.4 Lever handles: plain design.

.5 Normal strikes: box type, lip projection not beyond jamb.

.6 Cylinders: key into keying system as directed.

.2 **Butts and hinges:**

.1 Provide mortise type hinges, steel based for interior doors and stainless steel or brass for exterior doors or interior doors exposed to moisture.

.2 Provide hinges with stainless steel pins; non removable for exterior and public interior exposure, non-rising for non-security exposure.

.3 Provide full length continuous geared hinges, continuous pin and barrel hinges or full mortise type heavy weight butt hinges on all high frequency use or extreme weighted doors.

.4 Where doors are required to swing 180 degrees, provide ball bearing type swing clear hinges sufficient to clear trim.

.5 Only those hinge manufacturers specified in the hardware schedule and the alternates listed below shall be accepted.

.3 **Door Stops and Holders**

.1 Wall stops are only to be used on wall conditions such as block or masonry. If necessary to mount on drywall, provide proper backing to ensure no damage to the wall.

.2 Supply floor stops of sufficient height to suit floor conditions and the undercut of the door.

.3 Provide gray rubber exposed resilient parts.

.4 Surface mount overhead door stops may be used unless they conflict with the door closer. All overhead stops are to be set to 90 degree opening unless stated otherwise.

.5 Only those manufacturers specified in the hardware schedule and the alternates listed below shall be accepted:

Door Stop MFG	Door Stop Type	Alternate MFG
CBH	Floor Stop 87	No Alternates
CBH	Wall Stop 140	Standard Metal /Hager

.4 Door Closers and Accessories:

.1 All closers shall be hydraulically controlled and full rack and pinion in operation.

.2 All closers shall be fully adjustable including the following features: back check, speed control, and latch speed control.

.3 Provide mounting plates where required on special frame applications.

.4 Install all necessary attaching brackets, mounting channels, and cover plates where necessary for correct application of door closers.

.5 Supply to the Owner any special keys and wrenches as usually packed with door closers.

.6 Closers complete with a cover unless specified otherwise by the Consultant. Provide cover of matching architectural finish to the other hardware used in the project.

.7 Coordinate closers with overhead stops & holders.

.8 Only closer manufacturers specified in the hardware schedule and the alternates listed below shall be accepted:

Specified Closer MFG	Closer Type	Alternate MFG
LCN	4040 Series	Norton 7500 Series
LCN	4030 Series	Norton 8500 Series

.5 **Auxiliary hardware:** to ANSI/BHMA A156.16, designated by letter L and numeral identifiers as listed below.

.1 Stop, wall mounted.

.2 Door silencer.

.6 **Thresholds:** 150 mm wide x full width of door opening, extruded aluminum, plain surface, with thermal break of rigid PVC, with vinyl door seal insert.

.7 **Astragal:** adjustable, extruded aluminum frame with vinyl insert, finished to match doors.

.8 **Mechanically Operated Key Access Pads:** to ANSI/BHMA 156.2 have 1 certification and weather resistant with key override model. Keys Simplex L1000 lever handle or equal and approved. Refer to floor plans for locations, may not be indicated on door schedule.

.9 **Push Plates and Door Pulls**

.1 Provide and install stainless steel plates in type #304 stainless steel and install secure with screw fastening.

.2 Length of kick plates shall be 38mm less than door width for single doors and 1" less than door width for doors in pairs.

.3 All stainless steel plates are 0.050" thick, free of rough or sharp edges. Corners and edges to have slight radiuses. Install kick plates and armor plates on both sides of the door with 3M tape or counter sunk screws as specified.

.4 Where door pulls are scheduled on one side of door and push plates on other side, issue installations instructions to ensure that the pull is secured through door from reverse side and countersunk flush with door installation of push plate. Locate push plate to cover fasteners for door pulls.

.5 Only those Push Plate and Door Pull manufacturers specified in the hardware schedule and the alternates listed below shall be accepted:

Push/Pull MFG	Push/Pull Type	Alternate MFG
CBH	7023-1	Standard Metal / Hager
CBH	923 B 5@ x 20@	Standard Metal / Hager

.10 **Door Seals and Thresholds**

.1 Perimeter seals must be provided that fully seal all gaps between the floor, door and frame. Perimeter seal must protect against weather, smoke and sound.

.2 Frame gasketing must be constructed of neoprene. The aluminum housing must have a rib to prevent against distortion during installation.

.3 Provide aluminum frames with felt inserts by door supplier.

.4 Install Thresholds in a manner that ensures the door bottom comes in full contact.

.5 All thresholds shall be aluminum and installed with lead shields and stainless steel screws.

.6 Cut ends of thresholds to follow exactly the door frame profile.

.7 Only those manufacturers specified in the hardware schedule and the alternates listed here will be accepted.

Seals/ Threshold MFG	Seals/ Threshold MFG	Alternate MFG
Zero	8144S	National Guard
KNC	Door Sweep W-24S	National Guard
KNC	Threshold CT-10	National Guard

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Doors, padlocks and cabinet locks to be master keyed, as directed. Prepare detailed keying schedule in conjunction with Departmental Representative.

.2 Supply keys in duplicate for every lock in this Contract.

.3 Supply 3 master keys for each master key group.

.4 Stamp keying code numbers on keys and cylinders.

.5 Supply construction cores.

.6 Hand over permanent cores and keys to Departmental Representative.

3 Execution

3.1 INSTALLATION

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

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Install key control cabinet.

.7 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.8 Remove construction cores when directed by Departmental Representative.

.1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

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

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

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.2 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.4 DEMONSTRATION

.1 Keying System Setup and Cabinet:

.1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.

.2 Place file keys and duplicate keys in key cabinet on their respective hooks.

.3 Lock key cabinet and turn over key to Departmental Representative.

.2 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware.

.2 Description, use, handling, and storage of keys.

.3 Use, application and storage of wrenches for door closers, locksets and fire exit hardware.

.3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by door hardware installation.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply and installation of automatic swing door operator, surface mounted onto suitable transom, and complete with accessories required for complete finish, installation and operation.

1.2 RELATED REQUIREMENTS

.1 Section 08 70 00: Hardware

1.3 REFERENCE STANDARDS

.1 American Association of Automatic Door Manufacturers (AAADM)

.2 American National Standards Institute (ANSI):

.1 ANSI A156.19 – Power Assist and Low Energy Power Operated Doors

.2 ANSI 117.1 – Accessible and Usable Buildings and Facilities

.3 Builders' Hardware Manufacturers Association (BHMA)

.4 Underwriters Laboratory Canada (ULC)

.5 Canadian Standards Association (CSA)

.6 National Fire Protection Association (NFPA)

.7 International Code Council (ICC)

1.4 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Design system to operate, hold open and close doors under design wind and suction loads calculated in accordance with applicable code.

.2 Provide for thermal expansion and contraction of door and frame units, transmitted to operating equipment.

.3 Provide for dimensional distortion of components during operation.

.4 Operating Temperature Range: -33 deg. C to 72 deg. C ambient.

.5 Eliminate system performance interference by ambient light and radio frequencies.

.6 Provide for manual open and close operation of door leaves in the event of power failure.

1.5 QUALITY ASSURANCE

.1 Manufacturer's Qualifications: Manufacturer to have at least (5) five years experience in the fabrication of automatic and manual entrance systems.

.2 Subcontractor executing work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.3 The installation shall be in conformity with laws, by-laws and regulations which govern the design and installation of automatic entrance doors.

.4 Installer's Qualifications: Products specified shall be represented by a factory authorized and trained distributor. Distributor shall be AAADM Certified and maintain a parts inventory and trained service personnel capable of providing service

.5 Pre-installation Conference:

.1 Schedule a pre-installation conference no later than one week prior to commencing work of this Section.

.2 Contact Contractor two weeks prior to proposed meeting to confirm schedule.

.6 All automatic equipment to comply with UL325 and CAN/CSA-C22.2 No 247-92.

.7 All automatic equipment to comply with ANSI A156.19.

1.6 SUBMITTALS

.1 Submit submittals in accordance with the General Conditions and Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data indicating installation details, material descriptions, dimensions of individual components and profiles, and finishes.

.2 Shop Drawings: Submit shop drawings indicating details of electrified door hardware including, but not limited to, the following:

.1 Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and site installed wiring.

.2 Submit complete elevations, details and methods of anchorage to location; installation of hardware; size, shape, joints and connections; and details of joining with other construction.

.3 Templates and Diagrams: As needed shall be furnished to fabricators and installers of related work for coordination of swinging door system with concrete work, electrical work, and other related work.

.4 Samples: Submit to Consultant for approval, before fabrication of the work, samples of materials, components, and finishes to be used in the work.

.5 Maintenance Data and Operating Instructions: On completion of work of this Section, supply three (3) copies of maintenance instructions for insertion into Operating and Maintenance Manual.

1.7 PROJECT CLOSEOUT SUBMISSION

.1 Operation and Maintenance Data: Provide operations and maintenance information in accordance with Section 01 33 00 Submittals - Operations and Maintenance Data.

.2 Spare Parts and Tools: Submit unique parts and tools for maintaining hardware system in accordance with Section 01 33 00 Submittals.

1.8 DELIVERY, HANDLING AND PROTECTION

.1 Pack hardware in suitable wrappings and containers to protect from injury during shipping and storage. Enclose accessories, fastening devices and other loose items with each item. Mark packages for easy identification as indicated on approved delivery schedule. Hand over hardware to designated installer.

1.9 SITE CONDITIONS

.1 Site Survey: Verify site conditions including, but not limited to the following; opening sizes, floor conditions, plumb and level mounting surfaces.

.1 Substrates shall be of proper dimension and material.

.2 Coordinate installation with glass, glazing hardware and electrical to avoid construction delays.

1.10 WARRANTY

.1 Warrant work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of two (2) years and agree to promptly make good defects which become evident during warranty period without cost to the Owner.

.2 Warrant that any unit failing shall be removed and replaced without cost to the Owner.

2 Products

2.1 MANUFACTURERS

.1 Supply all automatic door operators and accessories from one manufacturer to ensure compatibility of system components.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Besam Ltd.

.2 Horton Automatics

.3 Gyro Tech Inc

.4 Record-USA

2.2 AUTOMATIC SWING DOOR SYSTEM

.1 Coordinate the work of all trades, including glass and glazing, masonry, and electrical requirements covered in manufacturer's details and appropriate sections of the specifications.

.2 Coordinate with electrical contractor for provision of service to each operator from junction box for multiple operators.

.3 Coordinate with electrical contractor and provide electrical conduit and wiring from specified controls to operators as outlined on manufacturer's drawings.

.4 Finish Hardware Supplier: Provide and install the following automatic door operators and connecting hardware, and power on/off switch and safety sensor.

.1 Overhead Concealed Side Access (Type A): Provide and install overhead concealed swing door operator, for single or double doors, consisting of operator and electronic control, aluminum header.

.1 Basis of Design Material: Besam SW200i-OS by ASSA ABLOY.

.2 Surface Mount Single Push (Type B): High performance, heavy use application, surface mounted operator, complete with aluminum header case and arm link.

.1 Basis of Design Material: Besam SW200i by ASSA ABLOY.

.3 Concealed Floor Mount (Type C): Moisture resistant floor mount operator, encased in heavy gauge steel enclosure, complete with stainless steel fasteners.

.1 Basis of Design Material: Besam SW200i-IG by ASSA ABLOY.

.4 Automatic entrance equipment: comply with ANSI A156.10 or A156.19.

.5 Aluminum header extrusions: minimum nominal 4 mm wall thickness with finish anodized AA-M12-C22-A31 clear.

.6 Equipment must operate between -35 deg. C and +55 deg. C in all climate conditions.

.7 Operator: Electro-mechanical system installed in a header to resist dust, dirt and corrosion; entire operator shall be removable from the header as a unit.

.8 Bearings: Fully lubricated and sealed to minimize wear and friction.

.5 Electrical Control:

.1 Solid-state microprocessor unit, allowing the opening speed, closing speed, back check and latch check speed each to be adjusted separately and independently from each other to meet specific site conditions.

.2 Adjustable opening and closing speeds shall be set in accordance with ANSI A156.19.

.3 Control shall include time delay. All adjustments shall be specific and reproducible.

.6 The door forces and speeds generated during power opening, and manual opening in both directions of swing, and spring closing in both directions of swing shall conform to the requirements of ANSI A156.10 or A156.19.

.7 Verify that no defects or errors are present in completed phases of the work that would result in poor application or installation, or cause latent defects of the automatic door equipment.

.8 Installation and warranty adjustments shall be performed by authorized distributors' factory trained technician.

2.3 ACTIVATING DEVICES

.1 Wall Switches: Round push plate switch, 150mm (6") diameter stainless steel surface, engraved, mounted to pushbutton box, mounted to wall or frame, as indicated on the drawings.

.2 Bollard Post: 50mm (2") square narrow bollard post, tubular steel complete with welded cap, and surface mounted narrow activation switch. Surface mounted, 1066mm (42") high.

3 Execution

3.1 INSTALLATION

.1 Automatic door equipment shall be installed by AAADM Certified, factory-trained installers in compliance with ANSI A156.19, manufacturer's recommendations and approved shop drawings.

3.2 CLEANING AND PROTECTION

.1 After installation, clean framing members as recommended by the manufacturer.

.2 Protect aluminum surfaces in contact with masonry, concrete or steel by use of neoprene gaskets, where indicated, or a coat of bituminous paint to prevent galvanic or corrosive action.

.3 Advise general contractor to protect unit from damage during subsequent construction activities.

3.3 PERFORMANCE

.1 Provide services of certified technician without additional cost to Owner, to inspect and adjust installation of all hardware furnished under this Section to assure compliance with ANSI A156.10.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Furnish glazing materials and accessories to complete the fabrication and installation of:

.1 Hollow Metal Doors, Frames and Sidelights

.2 Glazing for Structural Glass and Steel Guards

.3 Curtain Wall Glazing

.4 Custom Washroom Mirrors

1.3 RELATED REQUIREMENTS

.1 Section 06 10 00: Rough Carpentry

.2 Section 07 92 00: Sealants

.3 Section 08 11 13: Metal Doors and Frames

.4 Section 05 73 13: Glazed Decorative Metal Railings

1.4 REFERENCES

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

.1 ASTM C542-05(2011), Standard Specification for Lock-Strip Gaskets

.2 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants

.3 ASTM C1172-09e1, Standard Specification for Laminated Architectural Flat Glass

.4 ASTM C1503-08, Standard Specification for Silvered Flat Glass Mirror

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass

.2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass

.3 CAN/CGSB-12.8-97, Insulating Glass Units

.4 CAN/CGSB-12.9-M91, Spandrel Glass

.5 CAN/CGSB-12.11-M90, Wired Safety Glass

.6 CGSB-12.20-M89, Structural Design of Glass for Buildings

.3 National Fire Protection Association (NFPA):

.1 NFPA 80-2013, Standard For Fire Doors and Other Opening Protectives

1.5 SUBMITTALS

.1 Submit submittals in accordance with the requirements of Section 01 33 00 Submittals

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data for each type of product specified. Data shall indicate compliance with specification and installation recommendations of manufacturer of products being used.

.2 Samples: Submit samples of materials if required by Consultant before commencing work of this section. Samples shall be clearly labeled with manufacturer's name and type.

.3 Shop Drawings: Submit shop drawings, to the Consultant for review prior to fabrication.

.4 Samples for Initial Selection: Submit samples for initial selection by Consultant:

.1 Submit samples of spandrel glass coatings, tinted glazing for review and acceptance by Consultant prior to ordering.

.5 Samples for Verification: Submit samples for verification including sample sets showing the full range of variations expected where products involve normal colour variations.

.6 Maintenance Data: Upon completion of installation, supply instructions covering re-glazing, adjustments and other relevant maintenance data.

1.6 QUALITY ASSURANCE

.1 Conform to the requirements of the Flat Glass Marketing Association Glazing Manual, latest Edition.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver packaged materials in their original containers with manufacturer's labels and seals intact.

.2 Storage and Handling Requirements: Store vertically, blocked off the floor in a weatherproof enclosure in original containers with manufacturers labels and seals intact until read for installation, and as follows:

.1 Install glass as soon as possible after delivery to site.

.2 Handle glass carefully to its place of installation.

.3 Prevent damage to glass, adjacent materials and surfaces.

1.8 SITE CONDITIONS

.1 Ambient Conditions: Maintain temperature, humidity and solar exposure conditions of Glass Glazing materials during shipping, storage and site installation as required by manufacturer to maintain warranty and performance of installed products.

1.9 WARRANTY

.1 Provide manufacturer’s warranty for the following types of glass listed, against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of Work:

.1 Seal Failure: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions.

.2 Evidence of Failure: Obstruction of vision by dust, moisture, or film on interior surfaces of glass.

.3 Allowable Specific Exclusions: Breakage resulting from thermal stress will be accepted as a limitation to the warranty in accordance with CAN/CGSB 12.20.

.4 Warranty Period: Ten (10) Years.

2 Products

2.1 MATERIALS

.1 Float Glass: In accordance with CAN/CGSB-12.3, glazing quality and as follows:

.1 Clear Glass: No tint

.2 Tempered Glass:

.1 Minimum 1/4" thick, clear, conforming to CAN/CGSB-12.1, Type 2, Class 'B'. Tempering shall be performed using horizontal tong free method. Provide 1/2" where indicated on drawings.

.1 Provide Category "I" Heat Strengthened tempered glass for spandrel panel applications.

.3 Laminated Safety Glass: In accordance with CAN/CGSB-12.1 and ASTM C1172 as follows:

.1 Glass: Clear, tempered glass.

.2 Type: 1 - Laminated.

.3 Class: B - Float Glass.

.4 Category: II - Fully Tempered.

.4 Mirrors, Silvered: to ASTM C1503 and as follows:

.1 Type: 1B - Float glass for high humidity use.

.2 Tint: Clear

.3 Edges: Pencil polished edge. Seal edges to prevent chemical or atmospheric penetration of backing.

.4 Mirror Clips: – C26 (polished chrome) finished steel, or stainless steel edge clips, with fastening concealed behind mirror.

.5 Gaskets:

.1 Neoprene/EPDM thermoplastic rubber type gaskets of sufficient thickness to be compressed 25% when installed, having 2,000 psi tensile strength, with 50 durometer shore A hardness plus/minus 5, maximum 30% resistance to permanent set, resistance to ozone without cracking, minimum elongation at break of 300% and conforming to ASTM C542.

.2 Colour - "Black".

.6 Sealant:

.1 One component, silicone base, solvent curing sealant conforming to ASTM C920. Colour as selected Later by Consultant.

.7 Glazing Compound:

.1 Non-hardening modified oil type glazing compound.

.8 Setting Blocks:

.1 Neoprene/EPDM rubber type, 4" long, with 40 to 50 durometer shore A hardness plus/minus 5; resistant to sunlight, weathering, oxidation and permanent deformation under load and wide enough to extend from fixed stop to opposite face of glass of thickness suitable to glazing condition to provide adequate glazing "bite".

.9 Spacer Shims:

.1 Neoprene/EPDM rubber type, with 40 to 50 durometer shore A hardness plus/minus 5; resistant to sunlight, weathering, oxidation and permanent deformation under load and of adequate thickness to provide correct glass to face clearance at least 1/8".

.10 Glazing Tape:

.1 Macro-polyisobutylene preformed glazing tape, 'Polyshim' or 'Vision Strip' by Tremco Ltd., division of RPM Company, or approved equal.

2.2 INSULATING GLASS

.1 Insulating Glass Units: Provide sealed insulating glass units in accordance with CAN/CGSB-12.8 in configurations indicated, and as specified herein.

.2 Manufacture sealed insulating glass units without edge channels or tape, that is, with bare glass edges.

.3 Use two stage seal method of manufacture, as follows:

.1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator.

.2 Secondary Seal: polyurethane, silicone or polysulphide base sealant, filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.

.4 Install stainless steel capillary breather tubes to equalize pressure differentials between insulating glass fabricating location and insulating glass installation location; crimp tube immediately prior to installation in accordance with glass fabricators written instructions.

.5 Sealants for Insulating Glass Units:

.1 Primary Seal: Polyisobutylene; colour black.

.2 Secondary Seal: Structural silicone based; colour black.

.6 Insulating Glass Units:

.1 Unit Composition - up to 3’ above finish floor or grade:

.1 Exterior Lite: Clear tempered glass.

.2 Air Space: ½” Air Filled

.3 Interior Lite: Clear tempered glass having standard performance Low E coating on #3 surface.

.2 Unit Composition – between 3’ and top of glazing unit – Unless otherwise indicated on the Drawings:

.1 Exterior Lite: Clear float glass.

.2 Air Space: ½” Air Filled

.3 Interior Lite: Clear float having standard performance Low E coating on #3 surface.

.3 Low Emissivity Coating:

.1 Basis of Design Product: Sungate 500 by PPG Industries.

.2 Basis of Design Product: Solarban 60 by PPG Industries.

.7 Spandrel Insulating Glass Units: In accordance with CAN/CGSB-12.9 and as follows:

.1 Unit Composition:

.1 Exterior Lite: Type: 2 - Heat Strengthened complete with applied silicone elastomeric coating, minimum thickness 1/64”. Colour: As selected by the Consultant from the manufacturer’s standard product line.

.1 Basis of Design Materials:

.1 Opaci-Coat 300

.2 Span-Kote

.2 Insulation: Rigid glass fibre insulation held in place with manufacturer’s standard fixing system to back face of back pan.

.3 Back Pan – Concealed: Galvanized metal sheet, 1/16” thickness, formed into a pan shape to fit into glazing throat with back of pan flush with inside face of back section. If back pan is exposed to view, attach aluminum sheet to galvanized metal back pan by adhesive, finished to match mullions.

2.3 FABRICATION AND MANUFACTURE

.1 Label each light of glass with the registered name of the product and the weight and quality of the glass.

.2 Check dimensions on site before cutting materials.

.3 Minimum bite or lap of glass on stops and rabbets as recommended by glass manufacturer. Finish surfaces shall be free of tong marks.

.4 Cut glass true to dimensions, square, plumb and level. Verify all dimensions prior to fabrication.

.5 Distortion, pock marking or defects detrimental to appearance and/or performance, as determined by the Consultant, will be rejected.

.6 Fabricate mirrors to fit measurements of finished spaces, made at the site. Use one piece for mirrors 4’ or less in width. Make no horizontal joints except where indicated.

3 Execution

3.1 EXAMINATION

.1 Examine areas of work affecting the work of this section. Report in writing all defects, errors and discrepancies immediately to the Consultant.

.2 Commencement of work implies acceptance of surfaces and conditions.

3.2 PREPARATION

.1 Openings shall be free from moisture, frost, rust, dirt and foreign matter.

.2 Clean surface to receive sealant with a clean cloth dampened with xylol or a 50-50 mixture of acetone and xylol. Wipe dry with a clean, dry cloth.

3.3 INSTALLATION

.1 Conform to the recommendation of the glazing manual, Flat Glass Marketing Association, latest edition and as specified herein.

.2 Unless otherwise indicated on drawings otherwise, provide tempered glass at all doors, transoms, sidelights and vision lites within 2'-6" of grade and/or finished floor.

.3 Glaze doors scheduled to be glazed.

.4 Set sheet glass with draw lines horizontal.

.5 Glaze interior openings using compound or glazing tapes or gaskets.

.6 Install removable stops. Insert spacer shims between glass and stops at 24" O.C. and not less than 1/4" below "sight lines". Fill remaining voids with sealant or glazing compound to "sight lines" and trim sealant/glazing compound to produce clean, sharp, straight lines without voids or depressions.

.7 Replace loose stops in their original positions, tighten all screws.

.8 Refer to drawings and door and frame schedule for locations of each type of glass.

3.4 INSTALLATION – MIRRORS

.1 Secure mirrors with a minimum of 4 clips per piece. Provide pads to prevent direct metal-to-glass contact of clips or screws.

.2 Align mirrors (in multiple application) to a parallel and true plane surface to produce a true reflection across all sections.

.3 Place plumb and level.

3.5 CLEANING

.1 Repair all defects caused by the work of this section. Remove as work progresses, all excess or foreign materials or droppings which would set or become difficult to remove from surfaces at time of final cleaning.

.2 Immediately prior to acceptance of work of this section by Consultant, remove temporary protection, clean and polish exposed surfaces of all work of this section. Use proper cleaning

materials and methods to prevent damage to surfaces, finishes, sealer or work of other trades. Make good such damage to Consultant's satisfaction.

.3 Do not use steel wool, wire brushes or steel scrapers on any finished surfaces.

.4 Replace or make good to Consultant's satisfaction, upon completion of work of this section, all defective, scratched or damaged work, at no extra cost to the Owner.

3.6 GLAZING SCHEDULE

.1 Hollow Metal Doors and Borrowed Lights:

.1 Single 1/4” clear tempered safety glazed light, as indicated.

.2 Single 1/4” clear wired glazed light, as indicated.

.2 Exterior Windows:

.1 Insulating glass units, 1/4” frosted or tinted float exterior light; 1/4” clear float interior light.

.2 Spandrel Insulating glass unit, 1/4” frosted or tinted opaque exterior light; 1/4” spandrel interior light.

.3 Aluminum curtain wall:

.1 Vision areas/spandrel areas; insulating glass units, 1/4” tinted float exterior, 1/4” clear float interior.

.4 Washroom Mirrors:

.1 Single 1/4” non-tinted float glass mirror.

.5 Glass Guards:

.1 All glass balustrades shall be 3/4” thick clear tempered glass, edges flat ground.

.2 Align glass units plumb vertically and levelled with adjoining units, gapped as detailed. – Set shims at bottom of glazing channel, each side of glass, and at 3/8” below floor level. – Fill gap each side with dense resilient filler to within 3/8” of floor level.

.3 Shim and caulk glass into handrails slot.

.6 Hollow Metal Doors:

.1 Single ¼” fire-rated glazing composed of wire glass.

.7 Other glass types as indicated on drawings.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 21 13 – Board Insulation

.3 Section 07 21 16 – Blanket Insulation

.4 Section 07 26 00 – Vapour Retarders

.5 Section 07 46 23 – Wood Siding

.6 Section 07 84 00 – Fire Stopping

.7 Section 07 92 00 – Joint Sealants

.8 Section 08 11 00 – Metal Doors and Frames

.9 Section 08 50 00 – Windows

.10 Section 08 80 00 – Glazing

.11 Section 09 30 13 – Ceramic Tiling

.12 Section 09 91 00 – Painting

1.2 REFERENCES

.1 ASTM International

.1 ASTM C475-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C514-04(2009e1), Standard Specification for Nails for the Application of Gypsum Board.

.3 ASTM C557-03(2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.4 ASTM C840-08, Standard Specification for Application and Finishing of Gypsum Board.

.5 ASTM C954-07, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.6 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.7 ASTM C1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C1280-99, Standard Specification for Application of Gypsum Sheathing.

.9 ASTM C1177/C1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.10 ASTM C1178/C1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.

.11 ASTM C1396/C1396M-09a, Standard Specification for Gypsum Wallboard.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate 300 mm long samples of corner and casing beads, and mouldings.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store gypsum board assemblies materials level off ground, and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

.3 Protect from weather, elements and damage from construction operations.

.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.

.5 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

.6 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

2 Products

2.1 MATERIALS

.1 Moisture and Impact Resistant Gypsum Board: 16 mm.

.2 Standard board: to ASTM C1396/C1396M regular, 16 mm thick Type X, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.3 Wash room Wall Panels: 6 mm – 10 mm solid phenolic panels, colour: white.

.4 Glass mat water-resistant gypsum backing board: to ASTM C1178/C1178M, 13 or 16 mm thick (refer to drawings), 1200 mm wide x maximum practical length. Denshield Tile Backer or approved equal.

.5 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C645.

.6 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.7 Resilient clips and drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.8 Nails: to ASTM C514.

.9 Steel drill screws: to ASTM C1002.

.10 Laminating compound: as recommended by manufacturer, asbestos-free.

.11 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.12 Shadow mould: 35 mm high, snap-on trim, of extruded PVC plastic 0.6 mm base steel thickness galvanized sheet pre-finished in satin enamel, white colour.

.13 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 VOC limit 250 g/L maximum.

.2 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.14 Polyethylene: to CAN/CGSB-51.34, Type 2.

.15 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.16 Joint compound: to ASTM C475, asbestos-free.

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.13 Erect drywall resilient furring transversely across studs, joists and between the layers of gypsum board, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 38 mm common nail and/or 25 mm drywall screw.

.14 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work has been approved.

.2 Apply single layer gypsum board to wood furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls to ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.3 Apply water-resistant gypsum board where wall tiles to be applied and adjacent to sinks. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

.4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.

.5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.7 Install gypsum board with face side out.

.8 Do not install damaged or damp boards.

.9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.

.6 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.7 Provide continuous polyethylene dust barrier behind and across control joints.

.8 Locate control joints where indicated, at changes in substrate construction, at approximate 10 m spacing on long corridor runs, and at approximate 15 m spacing on ceilings.

.9 Install control joints straight and true.

.10 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.11 Install expansion joint straight and true.

.12 Install cornice cap where gypsum board partitions do not extend to ceiling.

.13 Splice corners and intersections together and secure to each member with 3 screws.

.14 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.15 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.16 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.17 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.18 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.21 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.22 Mix joint compound slightly thinner than for joint taping.

.23 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.24 Allow skim coat to dry completely.

.25 Remove ridges by light sanding or wiping with damp cloth.

3.5 CLEANING

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

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

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

.2 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Drawings and Room Finish Legend to be provided during construction as requested.

.1 All final colours and textures to be selected by AECOM and PC through sample and submittal process.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Composite Tile Institute (CTI)

.1 ANSI A108.1-99, Specification for the Installation of Composite Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).

.2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).

.3 CTI A118.4-92, Specification for Latex Cement Mortar (included in ANSI A108.1).

.4 CTI A118.5-92, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1).

.5 CTI A118.6-92, Specification for Composite Tile Grouts (included in ANSI A108.1).

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

.1 ASTM C144-04, Specification for Aggregate for Masonry Mortar.

.2 ASTM C207-06, Specification for Hydrated Lime for Masonry Purposes.

.3 ASTM C847-06, Specification for Metal Lath.

.4 ASTM C979-05, Specification for Pigments for Integrally Coloured Concrete.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CGSB 71-GP-22M-78(AMEND.), Adhesive, Organic, for Installation of Composite Wall Tile.

.3 CAN/CGSB-25.20-95, Surface Sealer for Floors.

.4 Canadian Standards Association (CSA International)

.1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.

.2 CAN/CSA-A3000-03(R2006), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.5 Terrazzo Tile and Marble Association of Canada (TTMAC)

.1 Tile Specification Guide 09 30 00, Tile Installation Manual.

.2 Tile Maintenance Guide.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.1 Include manufacturer's information on:

.1 Composite tile, marked to show each type, size, and shape required.

.2 Cementitious backer unit.

.3 Dry-set cement mortar and grout.

.4 Divider strip.

.5 Elastomeric membrane and bond coat.

.6 Reinforcing tape.

.7 Levelling compound.

.8 Latex cement mortar and grout.

.9 Commercial cement grout.

.10 Organic adhesive.

.11 Slip resistant tile.

.12 Waterproofing isolation membrane.

.13 Fasteners.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Base tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

.2 Floor tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

.3 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.

.4 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

1.4 QUALITY ASSURANCE

.1 Quality Assurance Submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

.2 Manufacturer's Field Reports: manufacturer's field reports specified.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at composite tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.

.3 Maintenance material same production run as installed material.

2 Products

2.1 FLOOR TILE

.1 tile: Types, sizes colours and textures as selected by the Departmental Representative, from the manufacturer's standard product line.

.2 Approved Manufacturer: **Dekton or equal and approved.**

2.2 WALL TILE

.1 tile: Types, sizes colours and textures as selected by the Departmental Representative, from the manufacturer's standard product line.

.2 Approved Manufacturer: **Dekton or equal and approved.**

2.3 BASE TILE

.1 Base: coved; type, size, colour and texture to match adjacent flooring material.

2.4 MORTAR SETTING MATERIALS

.1 Manufacturers: Mortar and grout materials listed in this Section shall be of a uniform quality for each mortar, and grout component from a single manufacturer and each aggregate from one source or producer as follows:

.1 Flextile Ltd.

.1 MAPEI Inc.

.2 Custom Building Products Ltd.

.3 Laticrete International Inc.

.2 Surface Preparation Materials:

.1 Levelling Bed/Mortar Additive: Performance standard meeting requirements of ANSI A108.1, Type 2; Acceptable material:

.1 Flextile Ltd., Mortar Bed with #43 Additive.

.2 MAPEI Inc. Mapecem Premix PL50.

.3 Custom Building Products Level Quik Underlayment

.4 Laticrete 3701 Fortified Mortar Bed

.3 Interior Thin Set Wall System: Dry set mortar meeting or exceeding the requirements of ANSI A108.1 formulated for thin set applications of composite biscuit tile, factory sanded mortar consisting of portland cement, sand and additives requiring only potable water to be added for installation:

.1 Acceptable mortar materials:

.1 Flextile Ltd., #51 Floor and Wall Mix

.2 MAPEI Inc. Kerabond

.3 Custom Building Products Premium Blend Thinset

.4 Laticrete 317 Mortar

.4 Interior Thin Set Floor System: Dry set mortar meeting or exceeding the requirements of ASTM C627 for Heavy installation using latex modified, portland cement mortar meeting requirements of ANSI A108.1:

.1 Acceptable mortar materials:

.1 Flextile Ltd., #53 Floor Mix

.2 MAPEI Inc. Kerabond

.3 Custom Building Products Master Blend Thinset

.4 Laticrete 253 Thinset

.5 Large Format Tile Mortar: Medium bed, dry set polymer modified mortar system designed specifically for use with large format tile materials over 305mm x 305mm (12” x 12”), requiring only the addition of water, rated for extra heavy service installation:

.1 Acceptable mortar materials:

.1 Flextile Ltd., #50 PM Medium Bed Thin Set Mortar

.2 MAPEI Inc., Ultracontact

.3 Custom Building Products, Complete Contact

.4 Laticrete Sure Set

.6 Epoxy Adhesive Setting Materials: Thin set adhesive system using 100% solids epoxy resin and epoxy hardener meeting or exceeding the requirements for ANSI A108.1; stain proof, chemical resistant and having high temperature resistance, water cleanable.

.1 Acceptable materials:

.1 Flextile Ltd., Flex Epoxy 100 Setting

.2 MAPEI Inc. Ker 410 Kerapoxy Mortar

.3 Custom Building Products 100% Solids Epoxy Mortar

.4 Laticrete Latapoxy 300

2.5 MEMBRANES

.1 Crack Suppression Membranes: Load bearing, premanufactured self-adhering lightweight fabric reinforced crack isolation membrane; nominal 1 mm thick manufactured to accommodate in-plane substrate movement in thin set applications meeting requirements of ANSI A108.1 and as follows:

.1 Acceptable Materials:

.1 Complete Schluter System

.2 Flextile Ltd., 1000 Flexilastic Crack Isolation Membrane

.3 MAPEI Inc., Mapeguard 2

.2 Waterproofing Membranes: Required in all locations where tile is installed. Complete waterproof system to be installed in all shower and public areas prior to installing tile.

.1 Acceptable Materials:

.1 Complete Schluter – KERDI System (Waterproofing)

.2 Flextile Ltd., Flex WP-980 Waterproof and Crack Isolation Membrane

.3 MAPEI Inc. Mapelastic 315 Waterproofing and Reinforcing Fabric

2.6 GROUT

.1 Colouring Pigments:

.1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.

.2 Colouring pigments to be added to grout by manufacturer.

.3 Job coloured grout are not acceptable.

.4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.

.2 Cement Grout: to ANSI A108.1.

.1 Use one part white cement to one part white sand passing a number 30 screen.

.3 Commercial Cement Grout: to CTI A118.6.

.4 Dry-Set Grout: to CTI A118.6.

.5 Latex Cement Grout: to ANSI A108.1, fast curing, high early strength, polymer-modified, stain resistant, sanded mix for floors, unsanded mix for walls and floors with polished tiles commercial tile grout.

2.7 ACCESSORIES

.1 Trims: At all edges of tiles and transition of materials. Provide full range of stainless steel Schluter products to cover the different conditions.

2.8 MIXES

.1 Cement:

.1 Slurry bond coat: cement and water mixed to creamy paste. Latex additive may be included.

.2 Mortar bed for floors: 1 part cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand.

.3 Mortar bed for walls: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand.

.4 Levelling coat: 1 part cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.

.5 Bond or setting coat: 1 part cement, 1/3 part hydrated lime, 1 part water.

.6 Measure mortar ingredients by volume.

.2 Dry set mortar: mix to manufacturer's instructions.

.3 Organic adhesive: pre-mixed.

.1 Adhesives: maximum VOC limit 65 g/L.

.4 Mix bond and levelling coats, and grout to manufacturer's instructions.

.5 Adjust water volumes to suit water content of sand.

2.9 PATCHING AND LEVELLING COMPOUND

.1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

.2 Have not less than the following physical properties:

.3 Compressive strength - 25 MPa.

.4 Tensile strength - 7 MPa.

.5 Flexural strength - 7 MPa.

.6 Density - 1.9.

.7 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.

.8 Ready for use in 48 hours after application.

2.10 CLEANING COMPOUNDS

.1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

.2 Materials containing acid or caustic material are not acceptable.

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 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual, "Composite Tile", except where specified otherwise.

.2 Apply tile to clean and sound surfaces.

.3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.4 Maximum surface tolerance 1:800.

.5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.6 Lay out tiles so perimeter tiles are minimum 1/2 size.

.7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.8 Make internal angles square, external angles rounded bullnosed.

.9 Use bullnose edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.

.10 Install divider strips at junction of tile flooring and dissimilar materials.

.11 Allow minimum 24 hours after installation of tiles, before grouting.

.12 Clean installed tile surfaces after installation and grouting cured.

.13 Make control joints where indicated. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 00 - Joint Sealants. Keep building expansion joints free of mortar and grout.

3.3 WALL TILE

.1 Install in accordance with TTMAC detail 305W.

3.4 FLOOR TILE

.1 Install in accordance with TTMAC detail 309F.

3.5 FLOOR SEALER AND PROTECTIVE COATING

.1 Apply in accordance with manufacturer's instructions.

3.6 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 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.

3.7 WATERPROOFING

.1 Install waterproofing in accordance with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

.2 Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.8 CONTROL JOINTS AND SEALING

.1 Control joints of a flexible caulking material shall be placed every 4877mm to 6096mm (16 to 20') apart, directly over existing control joints and/or where indicated on drawings or as required in accordance with TTMAC Detail No. 301MJ-2016-2017, Details E, F and G, whichever is applicable. Control joints shall be placed around the floor perimeter at walls, around columns, and where tile abuts other hard materials or vertical surfaces. Saw cutting of tile after installation is prohibited. Tile shall be cut if required and installed along each side of control joints.

.2 Expansion joints must always be placed directly over all slab expansion joints in accordance with TTMAC Detail No. 301MJ-2016-2017, Details A and B, whichever is applicable.

.3 Locate expansion, control, contraction, and isolation joints, as indicated below, unless specifically indicated otherwise on the Drawings:

.1 Interior: 16’ maximum: 1/4" joint width.

.2 Exterior: 12’ maximum: 3/8" joint width.

.4 Joints around fixtures, pipes or other fittings shall be sealed with a sealant. Refer to Section 07 92 00 for type of sealants to be used.

.1 Colour of sealant shall match grout as selected later by Consultant.

3.9 CLEANING AND FINISHING

.1 Clean tiled areas after grouting has cured, using compatible solutions and methods as recommended by the manufacturer.

.2 Remove [latex-portland cement] [and epoxy] grout residue from tile as soon as possible.

.3 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation.

.4 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.

.5 Flush surface with clean water before and after cleaning.

.6 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Material and installation of site applied paint finishes to new exterior and interior surfaces, including site painting of shop primed surfaces.

.2 Related Requirements

.1 Section 08 11 00 – Metal Doors and Frames

.2 Section 09 21 16 – Gypsum Board Assemblies.

1.2 REFERENCES

.1 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.3 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: minimum of five years proven satisfactory experience.

.2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.

.3 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 on-site installations in accordance with Section 01 31 19 Project Meetings.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.4 SCHEDULING

.1 Submit work schedule for various stages of painting to Consultant for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.5 ACTION AND INFORMATIONAL 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 (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, and clear coating 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 13 mm gypsum board for finishes over gypsum board and other smooth 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 application instructions.

.7 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

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.

.2 Quantity: provide one - one four litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and 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.

.9 Waste Management and Disposal:

.1 Separate waste materials for reuse recycling in accordance with Section01 74 21 - Construction/Demolition Waste Management and Disposal.

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

.3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.6 Ensure emptied containers are sealed and stored safely.

.7 Unused paint and coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

.8 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.9 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.10 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.11 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.12 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

1.8 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Departmental Representative 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 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 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 15% for wood.

.2 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 Departmental Representative DCC Representative Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.

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.

.5 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.6 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Water-based.

.2 non-flammable.

.3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.4 Manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.7 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.8 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.9 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:

.1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes.

.11 Recycled water-borne surface coatings to contain 50 % post-consumer material by volume.

.12 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0ppm weight/weight total product.

.3 Cadmium in excess of 1.0ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 COLOURS

.1 After Contract award, submit proposed Colour Schedule to Departmental Representative for review.

.2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.

.3 Selection of colours from manufacturers full range of colours.

.4 Where specific products are available in restricted range of colours, selection based on limited range.

.5 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 Departmental Representative DCC Representative Consultant for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes in accordance 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.

2.5 EXTERIOR PAINTINGS SYSTEMS

.1 Galvanized Metal: not chromate passivated including structural fastenings, plates etc.

.1 EXT 5.3B – Alkyd, gloss level 1 finish.

.2 Dressed Lumber: structural timbers, doors, door and window frames, casings, battens, smooth facias, etc.

.1 EXT 6.3J - Waterborne light industrial, gloss level 5coating.

2.6 INTERIOR PAINTING SYSTEMS

.1 Structural steel and metal fabrications: columns, beams, joists:

.1 INT 5.1A - Quick dry enamel, gloss level 1 finish.

.2 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.

.1 INT 5.3A – Latex, gloss level 2 finish.

.3 Dimension lumber: columns, beams, exposed joists, underside of decking:

.1 INT 6.2A - Latex, gloss level 5 finish (over alkyd primer).

.4 Dressed lumber: including structural columns, beams, exterior wood accents:

.1 INT 6.3D: Semi transparent stain / alkyd varnish, gloss level 1 finish.

.5 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:

.1 INT 9.2A – Latex, gloss level 3 finish (over latex sealer).

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 Consultant 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 Plaster and gypsum board: 12%.

.2 Wood: 15%.

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 Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect building occupants and general public in and about the building.

.2 Exterior Surface Preparation:

.1 Clean and prepare exterior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and surface debris by vacuuming, 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 drying thoroughly. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.

.5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.

.6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

.2 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.4 Do not apply paint until prepared surfaces have been accepted by Consultant.

.5 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.

.3 Interior 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 Departmental Representative.

.4 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 vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent 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.

.5 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.

.6 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.

.7 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.

.8 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 blowing with clean dry compressed air and/or vacuum cleaning.

.9 Touch up of shop primers with primer as specified.

.10 Do not apply paint until prepared surfaces have been accepted by Consultant

3.5 APPLICATION

.1 Method of application to be as approved Consultant. Apply paint by brush, roller, air sprayer and/or 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 Boiler room, 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.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 55 26 – Traffic Control

.4 Section 01 61 00 – Common Product Requirements

.5 Section 01 74 00 – Cleaning and Waste Management

1.2 REFERENCES

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, (5th Edition).

.2 ASTM International

.1 ASTM A123/A123M-[09], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A276-[10], Standard Specification for Stainless Steel Bars and Shapes.

.3 ASTM B209M-[10], Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

.4 ASTM B210M-[05], Standard Specification for Aluminum-Alloy Drawn Seamless Tubes [Metric].

.5 ASTM B211M-[03], Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire [Metric].

.3 Canadian General Standards Board (CGSB)

.1 CGSB 62-GP-9M-[80], Prefabricated Markings, Positionable, Exterior, for Aircraft Ground Equipment and Facilities.

.2 CGSB 62-GP-11M-[78], Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing and Amendment.

.4 CSA International

.1 CSA G40.20/G40.21-[04(R2009)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA O80 Series-[08], Wood Preservation.

.3 CSA O121-[08], Douglas Fir Plywood.

.4 CSA W47.2-[11], Certification of Companies for Fusion Welding of Aluminum.

.5 CAN/CSA-Z809-[08], Sustainable Forest Management.

.6 GS-11-[11], Paints and Coatings.

.7 SFI-[2010-2014] Standard.

.5 Ontario Traffic Manual (OTM)

.1 OTM Book 7 – Temporary Conditions

.2 OTM Book 15 – Pedestrian Crossing Facilities

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings for all traffic signs and pedestrian crossing signs to be installed as part of this contract.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations.

.2 Replace defective or damaged materials with new.

2 Products

2.1 MATERIALS

.1 Sign supports:

.1 Steel posts: to be U-channel, hot dipped galvanized with 3/8-inch diameter holes on 2-inch centre for sign mounting.

.2 Mounting hardware including nuts, washers and bolts to be galvanized steel.

.3 Base plates for ground mounted signs: to ASTM B209M. Base plates for overhead supports: to ASTM B209M.

.4 Anchor and connecting bolts, 'U' clamps and miscellaneous hardware for overhead sign installations: fabricate from 304 stainless steel as specified in ASTM A276.

.5 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

.2 Signboards:

.1 Plywood: to CSA O121, 19 mm thick. Overlaid Douglas Fir, Medium Density CAN/CSA-Z809 or FSC or SFI certified, overlaid one side only with fibre or plastic sheet surfacing material.

.2 Aluminum sheet: to ASTM B209M, precut to required dimensions.

.1 Thickness for signboards up to 750 mm wide: 1.6 mm minimum.

.2 Thickness for signboards 750-1200 mm wide: 2.1 mm minimum.

.3 Aluminum extrusions: to ASTM B211M, [150] mm or [300] mm panels suitable for bolting together.

.4 T-shape stiffeners for signboards: to ASTM B210M.

.5 Connecting straps and brackets: to ASTM B209M.

.6 Aluminum materials: to ASTM B209M.

.7 Reflective sheeting and tape: to CGSB 62-GP-11M. Adhesive, class of reflectivity and colour as indicated.

.8 Transparent tape: flexible, smooth-surfaced, moisture resistant tape with pressure sensitive adhesive.

3 Execution

3.1 INSTALLATION

.1 Sign support:

.1 Erect supports as indicated. Permissible tolerance: 50 mm maximum departure from vertical for direct buried supports. Where separate concrete footings have been placed, erect posts with base plates resting on levelling nuts and restrained with nuts and washers. Permissible tolerance: 12 mm maximum departure from vertical.

.2 Coat underside of base plate with corrosion protective paint before installation. Connect shoe base to shaft with inside and outside fillet welds.

.3 Erect posts plumb and square to details as indicated.

.4 Single channel steel posts:

.1 Drive to required depth without damage to posts.

.2 If rock or concrete is encountered, drill hole to required depth and set post in sand.

.3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.

.2 Signboard:

.1 Fasten signboards to supporting posts and brackets as indicated.

.2 Fasten lane markers to signboard.

.3 Use strapping with crimped or bolted connections where signs fastened to utility poles.

3.2 CORRECTING DEFECTS

.1 Correct defects, identified by Parks Canada Representative and/or Consultant at no additional cost.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by traffic signage installation and salvage operations.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Sections of Division 1 apply to work of this Section.

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 10 91 13 – Miscellaneous Specialities

1.2 SUBMITTALS

.1 Submit shop drawings clearly indicating compartment layouts and dimensions, the material being supplied and all connections, attachments, reinforcing, anchorage, hardware and location of exposed fastenings.

.2 Submit necessary templates and instructions where supports or anchors have to be built in by other Sections.

.3 Submit one sample of each of hinge, latch, shoe, panel fitting and other hardware items and fasteners; one sample of corner section 200 mm x 200 mm (8" x 8") showing corner, edge and core construction.

.4 Submit two samples of the finish selected for the compartment panels.

1.3 SAMPLE INSTALLATION

.1 Provide a sample installation in a washroom as directed before proceeding with remainder of installation.

.2 Make adjustments as required. After acceptance, retain approved sample as standard of quality for work of this Section. Sample may become part of the permanent installation.

2 Products

2.1 MATERIALS

.1 Type: Floor anchored, overhead braced, the following products are acceptable provided they comply with the requirements of these Specifications, including changes to manufacturer's standard product as required; Polymer HDPE floor anchored, overhead braced Toilet Compartments by Global Partitions or Sierra Series 1092 by Bobrick Washroom Equipment.

.2 Phenolic plastic laminate: Self-Supporting Grade (SS), black core, textured solid colour surfaces as selected by Consultant from the manufacturer’s standard product line.

.3 Plastic Laminate Urinal Screens: 1114mm (42") long x 610mm (24") wide wall hung type solid phenolic urinal screens with institutional hardware.

.4 Stainless steel: Type 304, minimum 0.6 mm (24 gauge) for pilaster shoes

2.2 FABRICATION

.1 Fabricate work true to dimensions and square, with flat, smooth surfaces, free of waves, warping, buckles, rough areas and voids.

.2 Fabricate doors, pilasters and partition panels from phenolic plastic laminate, smooth and chamfer edges, 19 mm (3/4") thick for doors and pilasters, 12 mm (1/2") for panels.

.3 Finish metal components such that no weld marks, and no pitted or marred finishes occur in the installed work.

.4 Provide oversized compartments without-swinging doors and door pull at barrier free compartments.

2.3 HARDWARE AND ACCESSORIES

.1 All hardware and accessories to be stainless steel.

.2 Levelling mechanism: Threaded, adjustable, lockable bolts concealed by pilaster shoes.

.3 Brackets: Stainless steel. Aluminium is not acceptable.

.4 Fixing devices: One-way theft resistant, stainless steel or chrome plated brass/steel. Provide through sex bolts for hinges and latches.

.5 Pilaster shoes: Stainless steel sheet, formed and welded, No. 4 finish.

.6 Hinges: Stainless steel, adjustable to hold doors in any position when not latched.

.7 Door latch: Slide bolt latch, complete with rubber bumpered stop and keeper, bright polished, smooth, stainless steel, with provision for emergency door release operation.

.8 Coat hook and bumper: One for each door, combined coat hook and bumper, bright polished, smooth, chrome plated non-ferrous metal. Provide one for side wall installation in lieu of door mounted at handicapped compartments.

.9 Door pull: Type suited for out swinging doors, chrome plated non-ferrous metal.

3 Execution

3.1 INSPECTION

.1 Verify dimensions on the site before preparing shop drawings or proceeding with shop work.

3.2 INSTALLATION

.1 Install compartments secure, accurately positioned, plumb, level, square and free from sag and distortion in accordance with manufacturer's installation recommendations.

.2 Ensure spaces between panels and pilasters, between panels and walls and between pilasters and walls are of uniform consistent width and sized to ensure that it is not possible to see persons using the compartments.

.3 Leave 6 mm (1/4") space between wall and panel or end pilaster.

.4 Perform drilling of steel, masonry and concrete necessary to install the work of this Section. Rigidly fasten ceiling supported pilasters to overhead supports provided under another Section.

.5 Co-ordinate installation with the work of trades providing ceilings, wall and floor finishes, washroom accessories and other adjacent components and construction.

.6 Insulate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper or other approved means.

.7 Install hardware supplied under this Section and ensure that it is visually aligned.

.8 Apply fittings using theft proof screws. Secure shoes by positive mechanical means.

.9 Provide 3 anchor brackets at all locations where partition components abut walls.

.10 Equip out swinging doors with door pulls on both sides of door.

.11 Provide urinal screens where indicated. Anchor screen panels to walls with heavy duty brackets, vertical supports will not be permitted.

3.3 ADJUSTMENT

.1 Upon completion of the work or when directed, remove all traces of protective coatings or paper, and polish compartments.

.2 Test hinges, locks and latches and where necessary, adjust and lubricate. Set hinges so that doors stand open 30 degree when compartment is not in use. Ensure that compartments are in working order.

3.4 LEANING

.1 Clean and make good 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 debris, equipment and excess material resulting from the work of this Section from the site.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 ASTM International

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A653/A653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A924/A924M-09, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.3 CSA International

.1 CAN/CSA-B651-04, Accessible Design for the Built Environment.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Shop Drawings:

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

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.1 MATERIALS

.1 All accessories to be by Bobrick unless otherwise noted.

.2 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.

.3 Stainless steel sheet metal: to ASTM A167, Type 304, with No.4 satin finish.

.4 Stainless steel tubing: In accordance with ASTM A1008/A1008M, cold rolled, commercial quality; minimum nominal thickness as established by product type; surface preparation and metal pre-treatment as required for applied finish.

.5 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 **Toilet tissue dispenser:** double roll type, surface mounted, capacity of 500 double ply roll, roll under spring tension for controlled delivery.

.1 Model: Bobrick marble roll toilet tissue holder, **Code B-2746**, aluminum satin finish.

.2 **Combination towel dispenser/waste receptacle:** semi-recessed wall unit, approximately 430 mm wide, 190 mm deep. Interior of 0.8 mm galvanized steel, exterior of 0.8 mm stainless steel. Suitable for dispensing folded or roll paper towels. Removable galvanized steel waste receptacle, lockable access door with continuous full height stainless steel hinge.

.1 Model: Bobrick surface mounted mask receptacle, **Code B-3942**, stainless steel with satin finish located in shower areas near sinks.

.3 **Soap dispenser:** Sloan integrated soap dispenser to match faucet. Refer to mechanical.

.4 **Hand Dryers:** Integrated Sloan dryers to match faucet. Refer to mechanical.

.5 **Feminine napkin/tampon dispenser:** stainless steel surface unit including rough-in frame, min capacity 15 napkins and 20 tampons, free operation, key locked, continuous hinge front panel.

.1 Model: Bobrick sanitary napkin dispenser, Contura Services, **Code B-27**, stainless steel with satin finish.

.6 **Grab Bar:** Stainless steel grab bars to be provided as indicated on drawings and to comply with all N.B.C. requirements. by Bobrick or approved equal.

.1 Grab bars to be provided for all barrier free (Universal) water closets and showers.

.2 Grab bars by Bobrick or approved equal.

.7 **Collapsible Robe Hook:** in all showers and B.F. washrooms as per drawings

.1 Model: Bobrick surface mounted rob hook, **Code B-983**, stainless steel with satin finish.

.8 **Mirrors: Bobrick B2908** 18W x 36H

.9 **Diaper changing station:** Recessed Stainless steel by Bobrick or approved equal.

.1 Safety instructions in both official languages, graphic illustration, labeled with universally accepted symbol for "changing station".

.10 **Shelfs:**

.1 Model: Bobrick **B-298** x 18 stainless steel shelf.

.11 **Barrier Free Hinged Collapsible Seat:**

.1 Model: ACORN Shower-Ware **1103-10 Series**. Located in showers as per drawings. Stainless steel and phenolic folding shower seat.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanized concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 All finishes to be stainless steel where possible.

.2 Chrome and nickel plating: to ASTM B456, satin finish.

.3 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma, apply one coat Type 2 primer to CAN/CGSB-1.81 and bake, apply two coats Type 2 enamel to CAN/CGSB-1.88 and bake to hard, durable finish. Sand between final coats. Colour selected from standard range by Departmental Representative.

.4 Manufacturer's or brand names on face of units not acceptable.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Consultant.

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.

.2 Install grab bars on built-in anchors provided by bar manufacturer.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

.5 Install mirrors in accordance with Section 08 80 50 - Glazing.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Package or crate, and brace products to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

1.4 SUBMITTALS

.1 Submit submittals in accordance with the General Conditions and Section 01 33 00.

.2 Shop drawings:

.1 Indicate the following: methods of anchoring, thickness and finishes of materials, relationship of work of other sections, including all required cutouts, and all other pertinent data and information.

.3 Samples: When requested submit full size samples of all Products.

.4 Maintenance data: Three copies of instructions covering cleaning, replacement and other relevant maintenance data.

.5 Extended Warranty: Submit a written warranty in accordance with Section 01 33 00.

.1 Warranty period of 5 years

.2 Commencement: Substantial Performance of the Work

1.5 ELECTRICAL CO-ORDINATION

.1 Electrical Requirements: Coordinate wiring requirements and power characteristics of work with building electrical system. Do wiring in strict conformity with requirements of the Electrical Code and Electrical Sections.

.1 Work by Electrical Sections: Supply and installation of disconnect switch/junction box and power to the disconnect switch/junction box.

.2 Work by This Section: Wiring and connection at and from disconnect switch/junction box to motors, starters, switches, controls, safety devices and other items requiring power.

.2 Employ licensed electrician to wire and interconnect all operational and safety components for the Work. Terminate wiring required for connection to control circuitry and power at NEMA enclosures. Ground all control wiring.

.3 Electrical Components, Devices, and Accessories: CSA certified and labelled.

2 Products

2.1 MATERIALS

.1 Provide reinforcing, fastenings, and anchorage required for building in.

.2 Insulate between dissimilar metals, and metal and incompatible materials to prevent electrolysis with bituminous paint or other approved means.

.3 Do not attach manufacturer's name or trademark, plates, imprints or labels to products unless approved by Consultant.

2.2 FABRICATION

.1 Verify site dimensions prior to fabrication. Fabricate work true to dimensions and square. Finished work shall be free from distortion and defects detrimental to appearance and performance.

2.3 MISCELLANEOUS SPECIALTIES

.1 Refer to drawings and schedules for items required but not specified herein.

2.4 ENTRANCE MATS

.1 Lay-in, removable entrance mats, installed sections as indicated within the floor tile recess, mat direction as shown on drawing, colour as indicated herein.

.1 Manufacturer: 3M Canada Company.

.2 Model: Nomad 9100 Scraper Matting

.3 Thickness: 12.7mm.

.4 Roll Width (by length to suit): 3'-0" standard (2'-0" optional where required).

.5 Colour: Granite.

.6 Contact: Henderson Carpets & Mats, Port Coquitlam, B.C. Contact Stephen Henderson/Steve Zehr. Telephone 1-866-298-1111 or 604-472-1699. Facsimile 604-472-1629. E-mail steveh@hendersonmat.com.

.2 Fabricate mat(s) in minimum of four (4) sections. Refer to standard detail SD-210. Mat material to be laid at right angles to exterior entrance framing (unless noted otherwise); butt mat sections along their parallel edges within the recess; set within perimeter tile or tile/aluminum edging as specified. Refer to Interior Colour Schedule for tile to entrance mat adapter.

.3 Allow product to relax and come to room temperature in a flat state for minimum two (2) hours prior to installation.

.4 Locate, align, set and level mats with top flush with adjacent finished floor.

.5 Maintain uniform 1/8" additional length per 6'-0" of mat length for a snug fit at perimeter between mats and frame.

2.5 INTERIOR WALL PANELS FOR BATHROOMS

.1 Option One (Phenolic Wall Panel):

.1 Manufacturers: Stonewood Interior Architectural Phenolic Panel System

(Or approved Equal)

.2 Accessories: As required

.3 Finish: Selected by Architect and Parks Canada

.2 Option Two (Acrovyn High-Impact Wall):

.1 Manufacturers: CS Acrovyn

(Or approved Equal)

.2 Accessories: As required

.3 Finish: Selected by Architect and Parks Canada

2.6 JANITOR'S CLOSET SHELVING

.1 Adjustable, heavy duty wire shelves, 2" high x 48" wide x 12" deep. Three (3) required. Location as shown on drawings. Top shelf at 74" AFF, bottom shelf at 49" AFF, mounted above top of wall panel. Bottom of uprights to align with top of wall panel. One (1) intermediate shelf required. Installation details similar to SD701.

.2 Ensure framing, reinforcement and anchoring devices are secured and positioned to suit.

.3 Manufacturer: Rubbermaid or Closetmaid.

.4 Accessories: Standards, uprights, shelf brackets, end caps and installation hardware as required by manufacturer.

.5 Finish: White, epoxy coated steel.

3 Execution

3.1 EXAMINATION

.1 Examine substrate surfaces to receive the Work of this Section and ensure that work done as part of the Work of other Sections is complete and that there are no conditions which will adversely affect the performance of this Work.

.2 Do not proceed with work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Securely fasten work level and plumb in the locations shown on the drawings and as specified herein.

.2 Co-ordinate installation with the work of Sections providing adjacent construction as required.

.3 Execute electrical work by qualified electricians and in compliance with the Canadian Electrical Code and other requirements of authorities having jurisdiction.

3.3 ADJUSTMENT

.1 Upon completion of the work or when directed, remove all traces of protective coatings or paper.

.2 Test operation, adjust, lubricate and ensure that accessories are in perfect working order.

3.4 PROTECTION

.1 Promptly upon completion of work and following preliminary review by the Consultant, cover finished products and protect exposed corners and areas vulnerable to damage by persons or by the movement of materials, tools or equipment.

.2 Maintain protective coverings in good order until the Consultant instructs that they be removed.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Portable Fire Extinguishers

.2 Fire Extinguisher Brackets.

1.3 REFERENCES

.1 FM - Factory Mutual System - Approval Guide.

.2 NFPA 10 - Portable Fire Extinguishers..

.3 ULC - Fire Protection Equipment Directory.

1.4 SUBMITTALS

.1 Submit shop drawings and product data for each of the following:

.1 Portable fire extinguishers.

1.5 QUALITY ASSURANCE

.1 Perform Work to NFPA 10.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

.1 ULC listed and labelled.

.2 Rated and identified in conformance with CAN/ULC S508, "Rating and Fire Testing of Fire Extinguishers".

2 Products

2.1 GENERAL

.1 Manufacturers

.1 National Fire Equipment

.2 Badger

.3 Kidde

.2 Stored pressure, rechargeable type with hose and shut-off nozzle.

.3 ULC labelled.

2.2 MULTI-PURPOSE DRY CHEMICAL

.1 5lb (2.27kg)

.1 Type: multi-purpose (ABC) type, dry chemical

.2 Rating: minimum 3A:10Bc.

.2 10lb (4.54kg)

.1 Type: multi-purpose (ABC) type, dry chemical

.2 Rating: minimum 4A:60Bc

2.3 IDENTIFICATION

.1 Identify extinguishers in accordance with the recommendations of NFPA No. 10 and CAN/ULC-S508.

.2 Attach a tag or label to the extinguisher indicating the month and year of installation. Provide space for service dates.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Conform to NFPA 10

.3 Install with wall mounting bracket where not installed in cabinets.

3.2 APPLICATIONS

.1 Provide fire extinguishers where indicated and in conformance with the Ontario Fire Code and NFPA 10.

.2 Provide 5lb. (2.27kg) multi-purpose extinguishers in men and women washrooms.

.3 Provide 10lb. (4.54kg) multi-purpose extinguishers in mech./elec. room.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Circulators

.2 Pressure Switch for Submersible Pumps

1.3 REFERENCES

.1 ASHRAE 90A - Energy Conservation in New Building Design.

1.4 SUBMITTALS

.1 Submit shop drawings and product data for each pump.

.2 Shop drawings shall include the following:

.1 Pump type, capacity, power requirements.

.2 Controls.

.3 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

.4 Provide electrical characteristics and connection requirements.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

.2 Provide pumps with manufacturer's name, model number, and rating/capacity identified.

.3 Ensure products and installation of specified products are to recommendations and requirements of the following organizations:

.1 National Sanitation Foundation (NSF).

.2 American Society of Mechanical Engineers (ASME).

.3 Canadian Standards Association (CSA)

.4 National Electrical Manufacturers' Association (NEMA).

.5 Underwriters Laboratories of Canada (ULC).

.4 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitations, are non-overloading in parallel or individual operation, operate within 25% of midpoint of published maximum efficiency curve.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: CSA Listed and classified as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

.1 Provide five year manufacturer warranty for pumps.

1.9 EXTRA MATERIALS

.1 Provide two sets of pump seals.

2 Products

2.1 P-1 AND P-7 CIRCULATORS

.1 Furnish and install, as shown on the plans, ITT Bell & Gossett circulating pump. The pump shall have a check valve and shall be 115V/1ph/60Hz and be UL listed and CSA approved.

.2 The pumps shall be a wet rotor inline pump, lead free bronze body construction specifically designed for quiet operation. Suitable standard operations at 230° F and 175 PSIG working pressure. The pump internals shall be capable of being serviced without disturbing piping connections.

.3 The pump internals shall be capable of being serviced without disturbing piping connections.

.4 Pump shall be equipped with a water-tight seal to prevent leakage.

.5 Pump volute shall be of a lead free bronze for domestic water systems. The connection style on the bronze pumps shall be flanged.

.6 Flange to Flange dimension shall be standard Bell & Gossett booster sizes. Flange dimensions shall be HVAC industry standard 2 or 4 bolts sizes.

.7 Motor shall be a synchronous, permanent-magnet (PM) motor and tested with the pump as one unit. Conventional induction motors shall not be acceptable. Each motor shall have an Integrated Variable Frequency Drive tested as one unit by the manufacturer.

.8 Integrated motor protection shall be verified by UL to protect the pump against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).

.9 Pumps shall be UL 778 listed and bear the UL Listed Mark for USA and Canada with on-board thermal overload protection.

.10 The pump shall recognize a 10°C water temperature reduction and shall switch to nighttime operation.

.11 Each pump shall be factory performance tested before shipment.

.12 Refer to the schedule on drawing(s).

.13 Acceptable alternates subject to shop drawing review:

.1 Grundfos

.2 S. A. Armstrong

2.2 P-2 CIRCULATOR

.1 Furnish and install, as shown on the plans, ITT Bell & Gossett circulating pump with stainless steel body, impeller and shaft, carbon bearing and EPDM gasket. The pump shall have a check valve and shall be 115V/1ph/60Hz and be UL listed and CSA approved.

.2 Refer to the schedule on drawing(s).

.3 Acceptable alternates subject to shop drawing review:

.1 Grundfos

.2 S. A. Armstrong

2.3 PRESSURE SWITCH FOR SUBMERSIBLE PUMPS

.1 Furnish and install, as shown on the plans, Myers well pump pressure switch for the 3HP wet well pump, with low pressure cut-off feature and adjustable settings.

.2 Alternates subject to shop drawing review.

3 Execution

3.1 GENERAL

.1 Install pumps in accordance with the manufacturer's guidelines and as described in the contract documents.

.2 Commission pumps and leave in an operational condition.

3.2 CIRCULATORS

.1 In-line pump shall be supported from piping in true vertical alignment. For each pump, provide a shut off valve and strainer on the suction inlet side, and a check valve, balancing valve and shut off valve on the discharge side and pressure gauge.

.2 Confirm pump rotation is correct.

3.3 SEQUENCES OF OPERATION

.1 General

.1 Provide all components as required to provide the following sequences of operation:

.2 Wet Well Submersible Pump

.1 Provide and install the pressure switch in the potable water piping of mechanical room as shown on drawings. The pump shall be enabled when the potable water system pressure is below 205kPa (30PSI) and disabled when the system pressure is 580kPa (85PSI).

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Pipe, pipe fittings, valves, and connections for piping systems.

.1 Sanitary Sewer

.2 Sanitary Vent

.3 Domestic Water

1.3 REFERENCES

.1 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

.4 ASME B16.26 - Copper Alloy Bronze Fittings for Flared Copper Tubes.

.5 ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

.6 ASME B16.32 - Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.

.7 ASTM A74 - Cast Iron Soil Pipe and Fittings.

.8 ASTM B32 - Solder Metal.

.9 ASTM B42 - Seamless Copper Pipe, Standard Sizes.

.10 ASTM B68 - Seamless Copper Tube, Bright Annealed.

.11 ASTM B75 - Seamless Copper Tube.

.12 ASTM B88 - Seamless Copper Water Tube.

.13 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

.14 ASTM B302 – Thread-less Copper Pipe, Standard Sizes.

.15 ASTM B306 - Copper Drainage Tube (DWV).

.16 ASTM C1053 - Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.

.17 ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.

.18 ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

.19 ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

.20 ASTM D2564 - Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

.21 ASTM D2661 - Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

.22 ASTM D2665 - Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

.23 ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.24 ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer, Pipe, and Fittings.

.25 ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.

.26 ASTM D2855 - Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

.27 ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.28 ASTM E814 - Fire Tests of Through-Penetration Fire Stops.

.29 ASTM F679 - Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

.30 ASTM F708 - Design and Installation of Rigid Pipe Hangers.

.31 AWWA C651 - Disinfecting Water Mains.

.32 AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe (and Fabricated Fittings), 4" - 12" (100mm - 300mm), for Water Distribution.

.33 CISPI 301 - Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

.34 CISPI 310 - Joints with Hub-less Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

.35 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

.36 MSS SP69 - Pipe Hangers and Supports - Selection and Application.

.37 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.4 SUBMITTALS

.1 Submit a ‘Letter of Conformance’, indicating specified items selected for use in the project with the following supporting product data and reports.

.2 Provide data on valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

.3 Record actual locations of valves.

1.5 QUALITY ASSURANCE

.1 Perform Work to Province of Ontario standards. Maintain one copy on site.

.2 Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

.1 Perform Work to Canadian National Plumbing code.

.2 Conform to applicable code for installation of backflow prevention devices.

.3 Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Accept valves on site in shipping containers with labelling in place. Inspect for damage.

.2 Provide temporary protective coating on cast iron and steel valves.

.3 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

.4 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install underground piping when bedding is wet or frozen.

2 Products

2.1 SANITARY PIPING, BURIED

.1 ABS Pipe: ASTM D2661 or ASTM D2751.

.1 Fittings: ABS.

.2 Joints: ASTM D2235, solvent weld.

OR

.2 PVC Pipe: CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings".

2.2 SANITARY PIPING, ABOVEGROUND

.1 Cast Iron Pipe: CISPI 301, hub-less, service weight.

.1 Fittings: Cast iron.

.2 Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

.2 Copper Tube: ASTM B306, DWV.

.1 Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper, or ASME B16.32, solvent.

.2 Joints: ASTM B32, solder, Grade 50B.

2.3 WATER PIPING, BURIED

.1 Copper Tubing: ASTM B42, hard drawn.

.1 Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

.2 Joints: AWS A5.8, BCuP silver braze.

2.4 WATER PIPING, ABOVEGROUND

.1 Copper Tubing: ASTM B88M, Type L, hard drawn.

.1 Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

.2 Joints: ASTM B32, solder, Grade 95TA.

2.5 FLANGES, UNIONS AND COUPLINGS

.1 Pipe Size up to 3" (75mm):

.1 Copper tube and pipe: Class 150 bronze unions with soldered joints.

.2 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.6 VALVES – GENERAL

.1 Conform to requirements of ANSI, ASTM, ASME, and applicable MSS standards.

.2 Provide valves of the same manufacturer where possible.

.3 Manufacturer's name and pressure rating clearly marked on body to MSS-SP-25.

.4 Valid CRN (Canadian Registration Number) issued by Province of Ontario required for each valve.

.5 Materials:

.1 Bronze: ASTM B62 or B61 as applicable

.2 Brass: ASTM B283 C3770

.3 Cast Iron: ASTM A126 Class B

.6 End Connections:

.1 Flanged ends: ANSI B16.1 (Class 125), ANSI B16.5

.2 Face-to-face dimensions: ANSI B16.10

.7 Design and Testing:

.1 Bronze Gate & Check valves: MSS-SP-80

.2 Ball Valves: MSS-SP-110

.3 Cast Iron Gate Valves: MSS-SP-70

.4 Cast Iron Globe Valves: MSS-SP-85

.5 Cast Iron Check: MSS-SP-71

.6 Butterfly Valves: MSS-SP-67

.7 First named product as indicated in paragraphs below; other acceptable manufacturers, subject to shop drawing review.

2.7 ISOLATION VALVES

.1 Sizes up to 50mm (2"):

.1 Construction: MSS SP-110, 2 piece full port forged brass ball valve, cold working pressure 600psig (4,140kPa), threaded or soldered ends, PTFE seats, brass stem, chrome plated ball. Valves in insulated piping, provide a 2” (50mm) stem extension and extended operating handle of non-thermal conductive material, and protective sleeve that allows operation of valve without breaking the vapour seal or disturbing insulation.

.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

.1 Jenkins.

.2 Kitz Corporation.

.3 Watts Regulator.

.2 Sizes 65mm (2 1/2") and larger:

.1 Construction: MSS SP-70, gate valve with rising stem, cold working pressure 200psig (1,380kPa), ASTM A126 gray iron body with bolted bonnet and flanged ends, bronze trim, solid wedge disc and asbestos free packing and gasket.

.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

.1 Jenkins.

.2 Kitz Corporation.

.3 Watts Regulator.

.3 Sizes 65mm (2-1/2”) and larger:

.1 Construction: MSS SP-67, lug type, suitable for bi-directional dead-end service at a cold working pressure of 200psig (1,380kPa), without use of a downstream flange. Body material to ASTM A126 cast iron or ASTM A 536 ductile iron, EPDM seat, one or two piece stainless steel stem with extended neck in insulated piping, an aluminium bronze disc and a 10 position locking lever handle. Provide gear operators for valves 150mm and larger, and chain-wheel operators for valves mounted over 8-Ft (2400mm) above floor.

.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

.1 Jenkins.

.2 Kitz Corporation.

.3 Watts Regulator.

2.8 BALANCING VALVES

.1 Sizes up to 50mm (2"):

.1 Construction: MSS SP-80, cold working pressure 300psig (2,070kPa) with a bronze body with integral seat and union ring bonnet to ASTM B62, soldered or threaded ends, bronze stem, PTFE disc, asbestos free packing and either a malleable iron, bronze, or aluminium hand wheel.

.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

.1 Jenkins.

.2 Kitz Corporation.

.3 Watts Regulator.

2.9 CHECK VALVES

.1 Sizes up to 50mm (2"):

.1 Construction: MSS SP-80, cold working pressure 300psig (2,070kPa) with an ASTM B62 bronze body swing check with horizontal flow, threaded or soldered ends, and bronze disc.

.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

.1 Jenkins.

.2 Watts Regulator.

.2 Sizes 65mm (2-1/2”) and larger:

.1 Construction: MSS SP-71, cold working pressure 200psig (1,380kPa) with agray iron body and bolted bonnet to ASTM A126 and a clear or full waterway design, flanged ends, composition trim, bronze seat ring and disc holder, PTFE disc and asbestos free gasket.

.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

.1 Jenkins.

.2 Watts Regulator.

2.10 DRAIN VALVES

.1 Shut-off, for drips and drains, Crane/Jenkins model 901CJ complete with adaptor, 1400kPa (200psi); cold working pressure, bronze body, hose outlet, and threaded inlet, complete with 658 cap and chain.

2.11 PRESSURE REDUCING VALVES

.1 Pressure reducing valves shall be 2100kPa (300psig) rated, Watts Series 223, all bronze body construction, screwed union/thread connection, complete with bronze `Y' type strainer with removable stainless screen. Unit shall feature built-in integral by-pass, threaded bell housing to body connection for field servicing, and shall have set screw adjustment of integral spring connect to nylon reinforced Buna-n diaphragm assembly and piston type control.

.2 Each assembly shall have a field adjustable outlet pressure of 140 to 580kPa (20 to 85psig) with a variable inlet pressure of 550 to 2050kPa (80 to 300psig).

.3 Each unit shall be factory set to provide an outlet system pressure of pressure of 450kPa (65psig).

.4 Alternates: Wilkins, Conbraco, Febco.

2.12 RELIEF VALVES

.1 ASME rated, Wilkins Series P220 or Watts Series 3L pressure type, Wilkins Series TP220 or Watts Series 40 temperature and pressure type, relief valve with bronze body, bolted cap, non-metallic disc to metal seating, with elevated seat design, test lever and extended copper sheathed (thermostat) release mechanism.

3 Execution

3.1 EXAMINATION

.1 Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

.1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

.2 Remove scale and dirt, on inside and outside, before assembly.

.3 Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Provide non-conducting dielectric connections wherever jointing dissimilar metals.

.3 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

.4 Install piping to maintain headroom, conserve space, and not interfere with use of space.

.5 Group piping whenever practical at common elevations.

.6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

.7 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

.8 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with general trades.

.9 Establish elevations of buried piping outside the building to ensure not less than 4' (1.2m) of cover.

.10 Install vent piping penetrating roofed areas to maintain integrity of roof assembly; refer to Division 07.

.11 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer (maximum VOC content of 80g/L) to welding.

.12 Provide support for utility meters to requirements of utility companies.

.13 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting where required. Coordinate with general trades.

.14 Excavate and backfill as required for work of this Section.

.15 Install bell and spigot pipe with bell end upstream.

.16 Install valves with stems upright or horizontal, not inverted.

.17 Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

.18 Sleeve pipes passing through partitions, walls and floors.

.19 Inserts:

.1 Provide inserts for placement in concrete formwork.

.2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

.3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4" (100mm).

.4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

.5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

.20 Pipe Hangers and Supports:

.1 Install to OBC.

.2 Support horizontal piping as scheduled.

.3 Install hangers to provide minimum 1/2" (13mm) space between finished covering and adjacent work.

.4 Place hangers within 12" (300mm) of each horizontal elbow.

.5 Use hangers with 1-1/2" (38mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

.6 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.7 Provide copper plated hangers and supports for copper piping.

.8 Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

.9 Provide hangers adjacent to motor driven equipment with vibration isolation.

.10 Support cast iron drainage piping at every joint.

3.4 APPLICATION

.1 Install unions downstream of valves and at equipment or apparatus connections.

.2 Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

.3 Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

.4 Install globe valves for throttling, bypass, or manual flow control services.

.5 Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

.6 Provide spring loaded check valves on discharge of water pumps.

.7 Provide plug valves in natural gas systems for shut-off service.

.8 Provide flow controls in water re-circulating systems where indicated.

3.5 ERECTION TOLERANCES

.1 Establish invert elevations, slopes for drainage to 2% minimum. Maintain gradients.

.2 Slope water piping minimum 0.25% and arrange to drain at low points.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Floor drains

.2 Cleanouts

.3 Hose bibs

.4 Backflow preventers

.5 Hydrants

.6 Trap Seal Primers

.7 Expansion Tanks

.8 Master Thermostatic Mixing Valves

.9 Thermostatic Mixing Valves

.10 Trench drains

.11 Water Treatment

1.3 REFERENCES

.1 ASME A112.21.1 - Floor Drains.

.2 ASSE 1011 - Hose Connection Vacuum Breakers.

.3 ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.

.4 ASSE 1017 – Standard for Master Thermostatic Mixing Valves.

.5 ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

.6 AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

1.4 SUBMITTALS

.1 Submit shop drawings for each plumbing specialty.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Provide listing/approval stamp, label or other marking on plumbing specialties are made to the specified standard(s).

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Accept specialties on site in original factory packaging. Inspect for damage.

2 Products

2.1 GENERAL

.1 Manufacturer: Watts Drainage model indicated or equivalent by;

.1 Zurn

.2 Jay R. Smith

.3 Precision Plumbing Products

.4 Lawler

.5 Febco

2.2 FLOOR DRAINS

.1 Floor Drain (FD):

.1 Manufacturer: Watts Drainage model FD-100-C-5

.2 Epoxy coated cast iron floor drain with anchor flange, reversible membrane clamp with primary and secondary weep hole, ½” (13mm) thick 5” (125mm) adjustable nickel bronze strainer grate and no shank hub outlet.

.3 Accessories:

.1 Sediment bucket.

.2 Floor Drain (FFD):

.1 Manufacturer: Watts Drainage Model FD-100-C-EG

.2 Epoxy coated cast iron floor drain with anchor flange, reversible membrane clamp with primary and secondary weep holes, 1/4" (6mm) thick 5” (125mm) adjustable nickel bronze strainer, 4” x 9” (100 x 225mm) oval nickel bronze funnel and no hub outlet.

.3 Accessories:

.1 Sediment bucket.

2.3 TRENCH DRAINS [TD]

.1 Trench drain [TD-1]

.1 Manufacturer: Zurn Model No. Z882-HDS pre-sloped wide reveal trench drain system with 305mm wide x 2438mm long (12” x 96”) stainless steel frame, HDPE channels with 102mm (4”) no hub end outlet. System shall be frame anchored with stainless steel perforated grating to suit DIN Class C load rating. System shall include frame connectors, grate lockdowns, and connection covers.

.2 Trench drain [TD-2], [TD-3], [TD-4] & [TD-5]

.1 Manufacturer: ACO Quartz Premium Line pre-sloped trench drain system with standard or custom dimension of:

.1 [TD-2]: 84mm wide x 2490mm long (3.3” x 98”)

.2 [TD-3]: 84mm wide x 1000mm long (3.3” x 40”)

.3 [TD-4]: 84mm wide x 1695mm long (3.3” x 67”)

.4 [TD-5]: 84mm wide x 1400mm long (3.3” x 55”)

.2 304 Stainless steel 19 gage flange edge channel, Wave 304 Stainless steel 17 gage grating with integral 51mm (2”) center vertical outlet.

.3 Accessories:

.1 Stainless steel debris strainer

.2 Stainless steel clad flexible coupling.

2.4 TRAP SEAL PRIMERS [TSP]

.1 Electronic Type

.1 Electronic trap primer units shall be Precision Plumbing Products, models as follows:

.1 Model PTS-6 for up to 6 trap system

.2 Model PTS-2130 for up to 30 trap system

.2 Each unit shall be a packaged electronic trap priming manifold, to supply a minimum of 2oz. (59mL) water per outlet port (based on 60psi (413kPa) system pressure) minimum once in each 24 hour period for a period of six seconds.

.3 The entire unit shall be factory assembled and comply pre-piped etc. for installation and shall include:

.1 Bronze body 3/4" (19mm) female NPT ball valve

.2 Bronze 3/4" (19mm) water hammer arrestor

.3 Electronic brass body 3/4" (19mm) solenoid valve (120V)

.4 Atmospheric type vacuum breaker

.5 Type L copper outlet manifold

.6 1/2" (13mm) O.D. brass compression outlet fittings with orificed opening (for water balancing to each trap) connected from outlet manifold.

.4 Electrical components shall include:

.1 Single point 120V/1 ph /60 Hz power connection

.2 Manual override switch

.3 2 amp breaker

.4 24 hour field adjustable geared timer with adjustable dwell function (0-30 sec range)

.5 All components shall be factory mounted, assembled and tested, and supplied in a 16 gauge primed steel enclosure suitable for surface mounting (or recessed) mounting with hinged locking, door.

.6 All plumbing and electrical components shall be fully CSA approved.

.7 Unit shall be installed complete with 120” (3m) length of 14/2 with ground power cable with male 3-prong plug attached.

.8 Contractor shall `Cap Off' any unused water outlets.

2.5 CLEANOUTS [CO]

.1 Interior Finished Floor Areas:

.1 Watts Drainage Model CO-200-R

.2 Epoxy coated cast iron floor cleanout with 5-1/8” (130mm) round adjustable nickel bronze top and no hub connection.

.3 Watts Drainage Model CO-200-TS

.4 Epoxy coated cast iron floor cleanout with 5-1/8” (130mm) square adjustable nickel bronze standard top with tile recess and no hub connection.

.2 Interior Unfinished Accessible Areas

.1 Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

.3 Line Cleanouts

.1 Epoxy coated cast iron Malcolm type with cleanout ferrule, 1/2" (13mm) thick epoxy coated gasketed cover.

.4 Caulking for cleanouts .1 VOC content not to exceed 250g/L.

2.6 HYDRANTS

.1 Exterior Wall Hydrant – Single Temperature [WH-1]

.1 Watts Drainage Model HY-725

.2 Concealed non-freeze key operated wall hydrant with nickel bronze box and door, chrome plated hydrant face, integral vacuum breaker, 3/4" (19mm) hose connection, all bronze head, seat casting and internal working parts, galvanized wall casing and hydrant key.

.2 Interior Wall Hydrant – Single Temperature [WH-2]

.1 Watts Drainage Model HY-330

.2 Concealed key operated wall hydrant with nickel bronze box and door, chrome plated hydrant face, integral vacuum breaker, 3/4" (19mm) hose connection, all bronze head, seat casting and internal working parts, galvanized wall casing and hydrant key.

2.7 HOSE BIB [HB]

.1 Watts Drainage Series HB-1

.2 Brass body construction with 1/2" (13mm) copper x 3/4" (19mm) hose thread connection, hose coupling, integral vacuum breaker, built-in backflow protection, and cast iron hand wheel.

2.8 BACKFLOW PREVENTERS [BFP]

.1 Double Check Valve Assembly

.1 Watts Series LF007-QT-S.

.2 The Double Check Valve Assemblies shall be constructed using Lead Free cast copper silicon alloy. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be through a single bronze or stainless steel access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves; four top mounted, resilient seated test cocks.

.3 The assembly shall include epoxy coated quarter-turn ball valves and copper silicon alloy strainer.

.4 Compliance with CSA B64 and shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510.

2.9 EXPANSION TANK

.1 Expansion tank [ET-1]

.1 The expansion tank shall be a full acceptance bladder well tank, ASME rated for a working pressure of 862kPa (125psi) for commercial well water and booster pump systems. The tank shall include a replaceable heavy duty butyl bladder with a minimum thickness of 2.54mm (0.100ins). The tank shall include a sight glass and a stainless steel system connection.

.2 Basis of design is Amtrol Well-X-Trol. Alternates subject to shop drawing review:

.1 Xylem

.2 S. A. Armstrong

.2 Expansion tank [ET-2]

.1 ASME pre-charged for potable water diaphragm expansion tank, stamped 150psi (1034kPa) working pressure. Tank shall be supplied with a heavy duty butyl diaphragm and stainless steel system connection. An air charging valve connection shall be provided to facilitate adjusting pre-charge pressure to meet actual system conditions.

.2 Refer to schedule on drawing(s).

.3 Basis of design is Amtrol Therm-X-Trol. Alternates subject to shop drawing review:

.1 S. A. Armstrong

.2 Bell & Gossett

2.10 WATER TREATMENT

.1 Chlorination System [FIL-1A] & [FIL-1B]

.1 Basis of design is Grundfos Smart Digital Dosing Pumps. Alternates subject to shop drawing review.

.2 Provide two sets of “Grundfos GPT2710” simplex panels with the dimensions of 1200mm (48”) high and 600mm (24”) wide. Each panel shall include:

.1 One dosing pump

.2 Pressure relief valve

.3 Backpressure valve

.4 Calibration column

.5 Gauge and guard

.6 Drain connection

.7 Compression tube discharge connection

.8 Five ball valves

.9 Sch. 80 PVC piping with FKM unions pre-mounted on the panel

.10 Cabling pre-mounted on the panel

.3 Provide one dosing pump for each set of simplex panel. Pump model shall be “Grundfos DDA 12-10 FC-PV/V” with following specifications:

.1 FC Control mode: including graphical LCD, start/stop key, pulse control, auto deaeration, relay output, alarm relay, 4-20 mA analog input and analog output, weekly dosing timer, tank level control, integrated pressure sensor and flow control sensor in dosing head.

.2 Max. flow rate: 12 L/h

.3 Max Operating pressure: 10 bar

.4 PVDF dosing head

.5 FKM gaskets

.6 Ceramic ball valves

.7 Installation kit, including pump connection kits, foot valves and suction lances, PE discharge tube, PVC suction tube, PVC vent tube

.4 Provide two Grundfos injection units with ball valves.

.5 Provide one Grundfos 100Lit cylindrical transparent tank for chlorine storage, serving both dosing pumps of the two simplex panels. Complete with drain valve and floor mounting bracket

.6 Provide 6mm Dia. Polyethylene pipes for all chlorine tubing.

.7 Provide cables and plugs for connection to both chlorine analyzers

.8 Electrical requirements shall be 120volt, 1phase, 60Hz.

.2 Sediment Filter [FIL-2]

.1 The system shall be an automatic backwashing sediment filtration for the reduction of sediment and suspended solids down to 3-5 micron nominal particle size. The sediment filter shall be supplied complete, and assembled entirely by one manufacturer. System to include all components required for proper operation of the system. These components include mineral tank(s), sediment reduction media, gravel under-bedding, internal distributor system, system control valve, and backwash flow controller.

.2 Mineral Tank shall be constructed of a polyethylene liner with a continuous roving outer fiberglass reinforced wrapping. The tanks shall be Non-ASME code with a 150 psi maximum pressure rating, 120 deg. F (48 deg. C) maximum temperature rating, and NSF/ANSI certified to Standard 44 or 61. 14” diameter tanks and larger shall have a bottom base permanently installed with industrial grade adhesive. The tanks shall be provided with a 6” top flange or a 4” or 2.5” top threaded port for loading media and connection of the control valve. The tank shall be designed with a safety factor of 4:1 for minimum burst pressure.

.3 The sediment reduction media shall be a granular, hydrophilic, alumino-silicate based natural zeolite with a 3-5 micron nominal filtration rating. The surface of the media must be rough, with mineral projections to capture and hold sediment regardless of flow fluctuations. Smooth surface, hydrophobic media such as sand, anthracite, and garnet are not acceptable or equal. The media shall be certified by the National Water Quality Association to NSF/ANSI Standard 61 for drinking water system component-health effect. The media shall be Micro Z by Watts.

.4 The gravel under-bedding shall be a flint media. This media shall be washed to rid it of fines to prevent clogging of the lower distributor system. Enough gravel must be furnished to completely cover the lower distributor in the mineral tank(s).

.5 The internal distributor system shall come already installed in the sediment filter’s mineral tank(s). The screens/laterals of the internal distribution system shall be a slotted screen type diffuser. The slot cross section shall be a V shape to promote a self-cleaning characteristic of the slot while in the backwash flow mode. Slot size shall be .008” and not allow the zeolite granules to pass through and become present in the systems effluent water. Each screen will have an internal perforated pipe core to evenly distribute water flow across the entire lateral to prevent zeolite bed channeling. The lower distributor shall be a hub and lateral design for mineral tanks over 24” in diameter and single point design for mineral tanks 24” in diameter and below. The internal distribution system shall be made of abrasion resistant 20% glass filled polypropylene and have a maximum temperature limitation of 160 deg. F (71 deg. C). The distributor tube connecting the internal distribution system to the system control valve shall be made of polyvinyl chloride.

.6 The system control valve shall control all functions of the sediment filter’s back flushing, rinsing, and service cycles. The control valve shall be a multi-port type constructed of lead free brass as defined by the US EPA Safe Drinking Water Act and be tested and certified by the WQA to NSF/ANSI STD. 61 Section 8 Material Safety Only and ANNEX G. The control valve must also meet The State of California’s Proposition 65 Standards. Cycle positioning shall be motor driven, slow in actuation, and not cause pressure surges or water hammer. The system control valve shall be furnished with a fully programmable microprocessor based controller. Operating data from the system shall be stored within the controller. The controller shall have an LCD screen to display system operating data. Operating data shall be hours between last two regenerations and hours since last regeneration. The control valve will be provided with a three color LED display to indicate the position of the system. In service, regeneration, and standby positions will be indicated by the color of the LED. The valve will be supplied with a normally open and normally closed dry contact for interface with the building control system. The controller, related wiring, and positioning motors shall be housed within a NEMA 3 or equivalent enclosure. Back washing and rinse intervals will be based on pre-selected days programmed into the controller. A drain line flow control shall be provided to regulate the flow of water to drain during backwash and rinse cycles. The flow controller shall be

constructed of a sch. 80 PVC nipple or brass coupling with an orifice plate in the middle. Pressure sensitive rubber flow restrictors shall be installed in the orifice plate. These flow restrictors shall not be able to wash out of the plate and shall allow the consistent passage of water with pressure fluctuations between 30 to 100 psi.

.7 Warranty: Provide a 1 year parts and labor warranty for the system to protect against manufacturers defects. The system shall not be subjected to water temperatures above 110 deg. F (43 deg. C) or below 34 deg. F. (1 deg. C) nor shall it be subjected to pressure exceeding 125 psi. During operation the feed water pressure must not fall below 30 psi so proper backwashing can be performed. The zeolite attrition rate shall not be more than 3% per year.

.8 Electrical requirements are 120volt, 1phase, 60Hz.

.9 Basis of design is Watts Commercial Micro ‘Z’ Filter Systems model AMZ N5245-16-285NT. Alternates are subject to shop drawing review.

.3 Anti-Scale System [FIL-3]

.1 The system shall prevent scale by transforming dissolved hardness minerals into harmless, inactive microscopic crystal particles, as water travels up through the media. The system shall be installed on the main water service pipe just after it enters the building, but after other whole building water safety devices (backflow preventers), to effectively address water hardness concerns. The system shall be plumbed with a bypass valve to allow isolation of tank(s) and to allow the bypass of untreated water in the event that service or media replacement be necessary. The installation area should be suitable in size for the tank(s) to be serviced without encumbrance and sit upright on a flat level surface. The system must operate in an upflow manner and does not require additional water to backwash, flush, or regenerate once put into service. The system does not require any chemical additives and does not require electricity for operation.

.2 Provide flexible connections on the inlet and outlet plumbing to prevent plumbing and tank leaks.

.3 Warranty:

.1 The tank system shall be warranted to be free of defects in materials and workmanship for 5 years from the date of original shipment.

.2 The media shall be warranted for performance for a period of 2 years from the date of the original installation when installed and operated in accordance with the instructions in the corresponding Installation and Operation Manual.

.3 The cartridge systems shall be warranted to be free of defects in materials and workmanship for 1 year from the date of original shipment. Cartridges are warranted for performance for a period of one year from the date of original installation when installed and operated in accordance with the instructions in the corresponding Installation and Operation Manual.

.4 Basis of design is Watts OneFlow Lead-Free Anti-Scale System model OF1665-75TM. Alternates are subject to shop drawing review.

.4 Ultra-Violet Light Filter [FIL-4A] and [FIL-4B]

.1 The ultraviolet disinfection system shall be installed on the main water service pipe just after it enters the building, but after other whole building water safety devices (backflow preventers), to effectively address microbiological concerns. The system must be equipped with a flow switch that signals the lamp to dim to reduce heat and conserve electricity up to 46%. The system must have the ability to communicate with the lamp through radio frequency to identify that the correct lamps are being used and to log the hours of operation that the lamp has been in service. A properly sized 5 micron cartridge type prefilter must be installed just before the inlet to the system to reduce sediment. The installation area should be suitable in size for mounting of the system and have enough end clearance for replacing lamps and quartz sleeves.

.2 Unit shall include 316L SS chamber material, programmable system display, UV sensor with visual and audible alarm and lamp life monitor.

.3 Electrical requirements shall be 120volt, 1phase, 60Hz 100watt power input.

.4 Basis of design is Watts SmartStream UV 254 Nanometer Germicidal UV Disinfection System model WC040 with a 30mJ output. Alternates are subject to shop drawing review.

.5 Chlorine Analyzers

.1 Provide two (2) chlorine analyzers as shown on schematics.

.2 Basis of design is Chemtrac HydroAct HA4. Alternates are subject to shop drawing review.

.3 Include analyzer, free or total chlorine sensor, flow cell, (1) analog 4-20 mA output and data logging/download.

.4 Electrical requirements are 120volt, 1phase, 60Hz.

2.11 MASTER THERMOSTATIC MIXING VALVE

.1 Manufacturer: Leonard Model ECO-MIX XL-82-LF-BDT. Alternates are subject to shop drawing review.

.2 Manual thermostatic mixing valve with 25mm (1") IPS hot water inlet and cold water inlet, 32mm (1 1/4") IPS tempered water outlet, two stop and check valves with colour coded heat resistant handles on inlets, (internal parts of stainless steel construction), stainless steel mixing chamber with dial thermometer and ball valves, bronze finish, and a maximum operating pressure of 125 PSI (8.6 bar).

3 Execution

3.1 GENERAL

.1 Install all products in accordance with the plumbing code and with manufacturer's instructions.

3.2 FLOOR DRAINS AND TRENCH DRAINS

.1 Provide floor drains where indicated on architectural and plumbing floor plans.

.2 Inspect locations where floor drains are shown to determine that floor is sloped appropriately. Report concerns to Consultant prior to installation of drains.

.3 Coordinate installation with general trades.

.4 Trap and vent all floor drains in accordance with Plumbing Code.

.5 Provide trap seal priming for each floor drain trap.

.6 Floor drains in floors with surface membranes shall be installed with a membrane clamp and anchoring flange.

.7 Floor drains, traps and drain pipes installed in slabs on grade shall be embedded in concrete and made water-tight to prevent water seepage.

3.3 TRAP SEAL PRIMERS

.1 Traps may be primed from the flush tube of a flush valve or from the waste of a drinking fountain.

.2 No more than three (3) traps may be primed from one flush valve or one drinking fountain.

.3 Condensate drains from cooling units may not be used to prime traps.

.4 Trap seal primers shall be provided where flush valves and/or drinking fountains are not available.

.5 Group trap primers shall be provided where specifically shown and where agreed with the Consultant.

3.4 CLEANOUTS

.1 Cleanouts shall be the same size as the pipe up to 4" (100mm).

.2 Provide cleanouts at the end of mains and branches, at changes in direction, in long straight runs and at the base of all soil stacks and rainwater leaders and where required by code.

.3 Extend cleanouts to finished floor or wall surface.

.4 Encase exterior cleanouts in concrete flush with grade.

.5 Install floor cleanouts at elevation to accommodate finished floor.

.6 Cleanouts in floors with surface membranes shall be installed with a membrane clamp and anchoring flange.

.7 Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.

.8 Ensure clearance at cleanout for rodding of drainage system.

3.5 HYDRANTS

.1 Locate wall hydrants where indicated.

.2 Coordinate installation with general trades.

3.6 BACKFLOW PREVENTERS

.1 Backflow prevention includes backflow preventers, anti-siphon devices and vacuum breakers.

.2 Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur;

.1 on boiler feed water lines,

.2 housekeeping faucets,

.3 flush valves,

.4 interior and exterior wall hydrants (hose bibbs).

.5 where required by codes, regulations and/or standards.

.3 Pipe relief or drain from backflow prevention device to nearest drain.

.4 Install a strainer upstream of each backflow preventer.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Water closets, seats, tanks, flush valves, supplies, carriers

.2 Urinals

.3 Lavatories, faucets, spouts, waste, carriers

.4 Service sinks, traps, faucets, spouts, accessories

.5 Showers, head-arm-flange, valves, accessories

.6 Bottle filling stations

1.3 REFERENCES

.1 ASME A112.6.1 - (Floor Affixed) Supports for Off-the-Floor Plumbing Fixtures for Public Use.

.2 ASME A112.18.1 - Plumbing Fixture Fittings.

.3 ASME A112.19.2 - Vitreous China Plumbing Fixtures.

.4 ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).

.5 ASME A112.19.4 - Porcelain Enamelled Formed Steel Plumbing Fixtures.

.6 ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.

.7 ASSE 1017 – Standard for Master Thermostatic Mixing Valves

.8 CAN/CSA-B45.0 General Requirements for Plumbing Fixtures

.9 CAN/CSA-B45.1 Ceramic Plumbing Fixtures

.10 CAN/CSA-B45.2 Enamelled Cast Iron Plumbing Fixtures

.11 CAN/CSA-B45.3 Porcelain-Enamelled Steel Plumbing Fixtures

.12 CAN/CSA-B45.4 Stainless Steel Plumbing Fixtures

.13 CAN/CSA-B125.1 Plumbing Supply Fittings

.14 CAN/CSA-B125.2 Plumbing Waste Fittings

.15 CAN/CSA-B125.3 Plumbing Fittings

.16 CAN/CSA-B125.6 Flexible Water Connectors

1.4 SUBMITTALS

.1 Submit shop drawings and product data for each plumbing fixture.

.2 Maintenance data for each plumbing fixture and components.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum five years documented experience.

.2 Installer Qualifications: trades licence with minimum five years documented experience.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: CSA or ETL Canada Labelled.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Transport, handle, store, and protect products.

.2 Accept fixtures on site in factory packaging. Inspect for damage.

.3 Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

.4 Store plumbing fixtures on elevated platforms in dry locations.

1.8 WARRANTY EFFICIENCY

.1 The flow rates of fittings that supply water to a fixture shall not exceed the maximum flow rates at the test pressures listed in the table as follows:

Fittings	Maximum Flow		Test Pressure	
	GPM	LPM	PSI	kPa
Lavatory Faucet	1.84	8.35	60	413
Shower Head	2.09	9.50	80	550

.2 The flush cycle for each fixture that is a water closet or urinal, shall not exceed the maximum flush cycle listed in the table as follows:

Fixtures	Maximum Flush	
	Gal.	L
Water Closet (Valve)	1.32	6.0

2 Products

2.1 GENERAL

.1 Manufacturer as indicated or equivalent by;

.1 Fixtures: Crane, Eljer, Kohler, Vitra

.2 Faucet/Flush Valve: American Standard, Chicago Faucets, Delta

.3 Mixing Valve: Leonard, Symmons

.4 Seat: Beneke, Olsonite

.5 Carrier: Watts Drainage, Zurn

2.2 WATERCLOSETS

.1 Designation: W-1 (Barrier-Free)

.1 Fixture: Sloan Model No. ST-2039-STG elongated floor mounted vitreous china closet with ‘SloanTec’ antimicrobial glaze, siphon jet flush action bowl, 54mm (2-1/8”) fully glazed internal trapway, 292mm x 215mm (11-1/4” x 8-1/2”) large water surface, 4.0 to 6.0 LPF (1.1 to 1.6 GPF), 38mm (1-1/2”) rear spud.

.2 Flush Valve: Sloan 152-1.28 ES-S ‘Royal Optima’, concealed diaphragm type, sensor activated flushometer, low consumption, 4.8LPF (1.28GPF) factory set flow, rubber diaphragm with dual filtered fixed bypass, wheel handle back check, 3 second flush delay, self adaptive infrared sensor with indicator light, die cast sensor plate with no visible fasteners, non-hold open integral solenoid operator, courtesy flush override button, stop seat and vacuum breaker.

.3 Transformer: Sloan EL-154, 120volt, 60Hz primary, 24volt, 60Hz secondary, 50VA.

.4 Seat: Centoco 820STSS, elongated heavy duty solid plastic open front with cover, reinforced stainless steel self sustaining check hinge, posts, washers and nuts.

.2 Designation: W-2 (General Use)

.1 Fixture: Sloan Model No. ST-2469-STG elongated wall hung vitreous china closet with 'SloanTec' antimicrobial glaze, siphon jet flush action bowl, 54mm (2-1/8") fully glazed internal trapway, 292mm x 215mm (11-1/4" x 8-1/2") large water surface, 4.0 to 6.0 LPF (1.1 to 1.6 GPF), 38mm (1-1/2") rear spud.

.2 Flush Valve: Sloan 152-1.28 ES-S 'Royal Optima', concealed diaphragm type, sensor activated flushometer, low consumption, 4.8LPF (1.28GPF) factory set flow, rubber diaphragm with dual filtered fixed bypass, wheel handle back check, 3 second flush delay, self adaptive infrared sensor with indicator light, die cast sensor plate with no visible fasteners, non-hold open integral solenoid operator, courtesy flush override button, stop seat and vacuum breaker.

.3 Transformer: Sloan EL-154, 120volt, 60Hz primary, 24volt, 60Hz secondary, 50VA.

.4 Seat: Centoco 500STSCCSS, elongated heavy duty solid plastic open front less cover, reinforced stainless steel self sustaining check hinge, posts, washers and nuts.

.5 Carrier: Zurn ZN1201-N4 adjustable horizontal for siphon jet water closets.

.3 Designation: W-3 (Barrier-Free)

.1 Fixture: Sloan Model No. ST-2469-STG elongated wall hung vitreous china closet with 'SloanTec' antimicrobial glaze, siphon jet flush action bowl, 54mm (2-1/8") fully glazed internal trapway, 292mm x 215mm (11-1/4" x 8-1/2") large water surface, 4.0 to 6.0 LPF (1.1 to 1.6 GPF), 38mm (1-1/2") rear spud.

.2 Flush Valve: Sloan 152-1.28 ES-S 'Royal Optima', concealed diaphragm type, sensor activated flushometer, low consumption, 4.8LPF (1.28GPF) factory set flow, rubber diaphragm with dual filtered fixed bypass, wheel handle back check, 3 second flush delay, self adaptive infrared sensor with indicator light, die cast sensor plate with no visible fasteners, non-hold open integral solenoid operator, courtesy flush override button, stop seat and vacuum breaker.

.3 Transformer: Sloan EL-154, 120volt, 60Hz primary, 24volt, 60Hz secondary, 50VA.

.4 Seat: Centoco 820STSS, elongated heavy duty solid plastic open front with cover, reinforced stainless steel self sustaining check hinge, posts, washers and nuts.

.5 Carrier: Zurn ZN1201-N4 adjustable horizontal for siphon jet water closets.

2.3 URINALS

.1 Designation: U1

.1 Fixture: Kohler Model Steward K-4917 vitreous china waterless urinal, 50mm (2") outlet spud, two wall hangers, removable strainer and Kohler K-4929 maintenance balls. Include a minimum of two (2) maintenance ball cases.

2.4 LAVATORIES

.1 Designation: L-1 (General Use)

.1 Fixture: Sloan AER-DEC Integrated Sink System Model 83000, 2286mm wide x 597mm deep (90" x 23-1/2") wall hung unit with integral supports, stainless steel access doors and complete with:

.1 Three (3) Sloan ESD-400 soap dispensers.

.2 Three (3) Sloan Faucets EFX-200-003-0040-CP BASYS electronic faucet, polished chrome finish, center hole only, die cast body, integral above deck water supply shut off, optimal "Mid" height spout for effective hand washing, 167 mm (6-9/16") projection, 1.5 GPM (5.7 LPM) laminar, braided flexible supply hoses, active IR sensing, back up alkaline battery and Eaf-37 transformer.

.3 Three (3) Sloan EHD-510 hand driers.

.4 Three (3) Sloan EL-154 transformers.

.5 Three (3) Sloan Thermostatic mixing valves.

Colour to be selected by the Architect at shop drawing review.

.2 Supplies: Field fabricated.

.3 Waste Fitting: Integral to fixture.

.4 Trap: Field fabricated.

.2 Designation: L-2 (General Use)

.1 Fixture: Dupont Corian 810, center hole only, 462 mm (18-3/16") x 376 mm (14-13/16") front to back x 138 mm (5-7/16”) deep, counter mounted, acrylic polyester blend material with front overflow.

.2 One (1) deck mounted Sloan ESD-400 soap dispenser.

.3 Faucet: Sloan Faucets EFX-200-003-0040-CP BASYS electronic faucet, polished chrome finish, center hole only, die cast body, integral above deck water supply shut off, optimal "Mid" height spout for effective hand washing, 167 mm (6-9/16") projection, 1.5 GPM (5.7 LPM) laminar, braided flexible supply hoses, active IR sensing, back up alkaline battery and Eaf-37 transformer.

.4 Supplies: McGuire LFH170BV, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handles, escutcheon and flexible copper risers.

.5 Waste Fitting: McGuire 155WC Offset Open Grid Drain, cast brass one piece top, 17 GA. (1.5mm) tubular 32 mm (1-1/4") tailpiece.

.6 Trap: McGuire 8872C, chrome plated, 1.5mm (17ga.), brass adjustable body, 32mm (1-1/4”) and escutcheon.

.3 Designation: L-3 (Barrier Free)

.1 Fixture: Sloan AER-DEC Integrated Sink System Model AD-81000, 762mm wide x 597mm deep (30” x 23-1/2”) wall hung unit with integral supports, stainless steel access door and complete with:

.1 One (1) Sloan ESD-400 soap dispenser.

.2 One (1) Sloan Faucet EFX-200-003-0040-CP BASYS electronic faucet, polished chrome finish, center hole only, die cast body, integral above deck water supply shut off, optimal "Mid" height spout for effective hand washing, 167 mm (6-9/16") projection, 1.5 GPM (5.7 LPM) laminar, braided flexible supply hoses, active IR sensing, back up alkaline battery and Eaf-37 transformer.

.3 One (1) Sloan EHD-510 hand dryer.

.4 One (1) Sloan EL-154 transformer.

Colour to be selected by the Architect at shop drawing review.

.2 Supplies: Field fabricated.

.3 Waste Fitting: Integral to fixture.

.4 Trap: Field fabricated.

2.5 SHOWERS

.1 Designation: SH-1

.1 Acorn Penal Ware 1741ADAFA-EVS1-MVC1-BRS-F1.6 Penal Pak - Wall Shower - ADA compliant, brass body valve, 14 gage, type 304 stainless steel, satin finish panel, fixed shower head, Hot & Cold electronic valve system, 1.6 GPM (6.1 LPM), mounting hardware for walls up to 8" thick, factory welded stainless steel recessed soap dish, chrome plated brass trims.

.2 Designation: SH-2 (Barrier Free)

.1 Acorn Penal Ware 1741ADAFA-EVS1-MVC1-BRS-F1.6 Penal Pak - Wall Shower - ADA compliant, brass body valve, 14 gage, type 304 stainless steel, satin finish panel, fixed shower head, Tempered electronic valve system, 1.6 GPM (6.1 LPM), hand held shower with 60" long, stainless steel reinforced hose, vacuum breaker, quick disconnect and mounting bracket, mounting hardware for walls up to 8" thick, factory welded stainless steel recessed soap dish, chrome plated brass trims.

.3 Provide electronic valve controllers and two (2) EVS shower valve controllers for the 16 showers and include transformers.

.4 Supplier to program the system according to client requirements for shower cycle and lock-out times, provide wiring diagram, one CPT computer programmer, and include site visit

2.6 SERVICE SINKS

.1 Designation: S-1

.1 Fixture: Fiat Products Model MSB 2424, molded stone single bowl, floor mounted 600mm x 600mm x 250mm (24”x 24” x 10”) service sink,

.2 Faucet: Fiat model 830-AA, chrome plated faucet with vacuum breaker, integral stops, adjustable wall brace, pail hook and 19mm (3/4”) house thread and spout.

.3 Supplies: Field fabricated.

.4 Waste Fitting: Included with the fixture and includes a stainless dome strainer and lint basket.

.5 Trap: Field fabricated.

.6 Accessories:

.1 Hose and bracket: Fiat Model 832-AA.

.2 Mop hanger: Fiat Model 889-CC.

.3 Drain connector.

.4 Stainless steel bumper guard: Fiat Model E-88-AA.

.5 Stainless steel wall guard: Fiat Model MSG2424.

2.7 BOTTLE FILLING STATIONS

.1 Designation: BF-1 (Barrier Free)

.1 Fixture: Elkay model LK4405BFFRK, wall mount, non-filtered non-refrigerated freeze-resistant bottle filling station. Unit shall be of 316 stainless steel, laminar flow, heavy duty vandal-resistant construction. Furnished with vandal-resistant mechanical bottle filler button. Product shall be wall mount (on-wall), for outdoor applications.

.2 Unit shall be lead-free design which is certified to NSF/ANSI 61 & 372.

.3 Finished colour shall be selected by owner at shop drawing review.

.4 Supply Fitting: Field fabricated.

.5 Waste Fitting: Integral.

.6 Trap: Field fabricated.

3 Execution

3.1 EXAMINATION

.1 Verify that walls and floor finishes are prepared and ready for installation of fixtures.

.2 Verify that electric power is available and of the correct characteristics.

.3 Do not proceed until unsatisfactory condition(s) have been corrected.

3.2 PREPARATION

.1 Rough-in fixture piping connections to minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

.1 Install each fixture with trap, easily removable for servicing and cleaning.

.2 Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons.

.3 Install components level and plumb.

.4 Install and secure floor mounted fixtures in place with bolts.

.5 Install and secure wall hung fixtures in place with wall carriers and bolts.

.6 Seal fixtures to wall and floor surfaces with sealant having VOC content not exceeding 250g/L, colour to match fixture.

.7 Solidly attach water closets to floor with lag screws.

.8 Install water supply stop valves in accessible locations

3.4 ADJUSTING

.1 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

.1 Clean plumbing fixtures and equipment.

3.6 PROTECTION OF FINISHED WORK

.1 Do not permit use of fixtures.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Instantaneous electric water heaters

.2 Tankless type propane fired water heaters

1.3 REFERENCES

.1 ASHRAE 90A - Energy Conservation in New Building Design.

.2 ASME Section 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.

1.4 SUBMITTALS

.1 Submit shop drawings and product data for each major piece of equipment.

.2 Shop drawings shall include;

.1 Dimension drawings of water heaters indicating components and connections to other equipment and piping.

.2 Electrical characteristics and connection requirements.

.3 Performance data.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Provide equipment with the manufacturer's name, model number, and rating/capacity identified.

.3 Ensure products and installation of specified products are to recommendations and requirements of the following organizations:

.1 American Gas Association (AGA).

.2 National Sanitation Foundation (NSF).

.3 American Society of Mechanical Engineers (ASME).

.4 National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).

.5 National Electrical Manufacturers' Association (NEMA).

.6 Underwriters Laboratories (UL).

1.6 REGULATORY REQUIREMENTS

.1 Conform to ASME Section 8D for manufacture of pressure vessels for heat exchangers.

.2 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

.1 Provide five year manufacturer warranty for domestic water heaters packaged water heating systems.

2 Products

2.1 TANKLESS TYPE WATER HEATERS – PROPANE FIRED

.1 The Tankless Commercial Rack System shall be factory assembled pre-plumbed system and includes six (6) A. O. Smith ATI-540H Condensing Tankless Water Heaters. The Commercial Rack System shall include 2 inch copper water supply lines, 2 foot long ¾ inch flexible stainless steel water lines to the heaters, 1 ½ inch schedule 40 gas supply pipe with 3 foot long ¾ inch CSST flexible gas lines to the heaters, and isolation valves with 150 psi pressure relief valves for each heater. The rack shall be assembled as a back-to-back design.

.2 The fully modulating, on-demand, condensing gas fired tankless water heater(s) shall be A. O. Smith Tankless Water Heater model ATI-540H, having a maximum input rating of 199,000 Btu/h and available in LP. The heater shall have ¾ in. male NPT water and gas connections. The inlet gas supply pressures shall be 8.0 in. WC (min.) up to 14 in. WC (max.) for LP.

.3 The heaters shall incorporate an integrated temperature controller that will provide diagnostic information, fault history, and heater set temperature.

.4 The heaters shall operate using 120 V / 60 Hz power source. The heaters shall incorporate a factory installed power cord.

.5 The heaters shall be vented with 3” or 4” diameter schedule 40 PVC or Category IV vent pipe.

.6 The heaters shall be common vented with schedule 40 PVC pipe using 8 inch pipe. The termination point outside building shall be stainless steel Category III.

.7 The intake pipe may use material such as PVC, ABS, aluminum, or Category IV pipe.

.8 Provide non-return connection for each of the water heaters connecting to the common vent system.

.9 The water heaters shall use a commercial grade copper, fin tube primary heat exchanger with quick release brass or bronze waterways. The secondary heat exchanger shall be constructed from stainless steel 316L.

.10 The heaters shall be controlled by an onboard solid-state printed circuit board which uses the following factory installed components: thermistors to monitor water temperature and exhaust temperature; a flow sensor to measure flow rate; a flame sensor to monitor combustion; an air-fuel ratio rod to measure and adjust air inputs in order to maintain optimal combustion efficiency. The heater also consists of inline fusing and surge absorbers for electrical surge protection, an electronic spark igniter, aluminized stainless steel burners, hi-limit temperature switches to monitor water and exhaust temperatures, modulating gas valve, dual freeze protection that will automatically fire the heater and use heating blocks to protect the heat exchanger, and an overheat cutoff fuse.

.11 The heaters shall use Multi-Unit controller. The Controller shall modulate the system for the most efficient performance and shall rotate the priority heater every 12 hours of operation time or 100 starts for balanced duty/cycle operation.

.12 Refer to schedule on drawing(s).

.13 Acceptable alternates subject to shop drawing review:

.1 Rheem

.2 Lochinvar

.3 John Woods

2.2 INSTANTANEOUS ELECTRIC WATER HEATERS

.1 Water heater(s) shall be as manufactured by RHEEM, with performance ratings as indicated in the schedule on the drawings. Water heater(s) shall have the CSA seal of certification and be factory equipped with a CSA/ASME rated temperature and pressure relief valve. Water heater(s) shall be equipped with inline flow regulator, digital temperature display and high limit control.

.2 Acceptable alternates subject to shop drawing review.

.1 Hubbell

.2 EEMAX

3 Execution

3.1 INSTALLATION

.1 Set domestic water heater in place where shown and install in strict accordance with manufacturer's written instructions and CGA requirements.

.2 Provide pressure relief valve for each water heater. Extend pressure relief valve outlet piping at full line size, complete to drain. Drains and overflows shall be piped to the closet drain outlet. Install flue as instructed.

.3 All interconnecting piping and valves shall be provided as indicated in schematic arrangement as detailed on drawings.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Pipe and pipe fittings

.2 Valves

.3 Accessories

1.3 REFERENCES

.1 ASME B16.5 - Pipe Flanges and Flanged Fittings.

.2 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.4 ASME B18.2.1 - Square and Hex Bolts and Screws Inch Series.

.5 ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings.

.6 ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.7 ASTM B 75M - Standard Specification for Seamless Copper Tube [Metric].

.8 ASTM B 837 - Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

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

.10 CAN/CSA B149.1 - Natural Gas and Propane Installation Code Handbook.

.11 CAN/CSA B149.2 - Propane Storage and Handling Code.

1.4 QUALITY ASSURANCE

.1 Welding Materials and Procedures: Conform to ASME Code.

.2 Welders Certification: To ASME SEC IX.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.4 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

.5 Valves: Manufacturer's name and pressure rating marked on valve body.

1.5 REGULATORY REQUIREMENTS

.1 Conform to CSA B149.10 Natural Gas and Propane installation code.

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation.

2 Products

2.1 PIPE AND FITTINGS

.1 Aboveground

.1 2” (50mm) and smaller: Black steel pipe ASTM A-53/A 53M, schedule 40 seamless with malleable iron screwed fittings.

.2 2-1/2” (65mm) and larger: Black steel pipe ASTM A-53/A 53M, schedule 40 seamless with butt welded fittings.

.3 Flexible copper tube to ASTM B 837 with either cast copper fittings to ASME B16.18 or wrought copper fittings to ASME B16.22.

.2 Buried

.1 Copper Tubing: ASTM B88M, Type K.

.1 Fittings: ASME B16.18, cast copper alloy or ASTM B16.22 wrought copper or bronze.

.2 Joints: AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.

.2 Copper Tubing: ASTM B88M, Type K, annealed.

.1 Fittings: ASME B16.26, cast bronze.

.2 Joints: Flared.

2.2 ISOLATING VALVES

.1 50mm (2") and smaller: MSS SP-78, Type II, cold working pressure 200psig (1,380 kPa), ASTM A48/A 48M or ASTM A126 cast iron body with lubrication-sealing system, regular pattern, brass plug, operating wrench and screwed ends.

.2 65mm (2-1/2") and larger: MSS SP-78, Type II, cold working pressure 200psig (1,380 kPa), ASTM A48/A 48M or ASTM A126 cast iron body with lubrication-sealing system, regular pattern, brass plug, operating wrench and flanged ends.

.3 Manufacturers: Nordstrom, Neo valve, P.R. DeZurik

2.3 PRESSURE REGULATING VALVES

.1 Pressure regulators shall be constructed of cast iron, undercoated, single coat polyester primer and high solids polyurethane top coat. NPT threads to ANSI/ASME B1.20.1. Regulators shall include colour coded pressure spring, electro-galvanized diaphragm plate, Bruna N diaphragm and seat disc, aluminium high strength orifice valve, stamped aluminium lever, polyester thermoplastic UV stabilized seal plug, Minlon plunger valve and guide, pressure adjustment screw, and relief valve stem, stainless steel vent screen and valve, relief valve spring and lever pin.

.2 Manufacturer: Canadian Meter 1800C series or equal.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that excavations are to required grade, dry, and not over-excavated.

3.2 COORDINATION

.1 Coordinate installation requirements with the local authority having jurisdiction.

.2 Coordinate with all disciplines.

3.3 PREPARATION

.1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

.2 Remove scale and dirt, on inside and outside, before assembly.

.3 Prepare piping connections to equipment with flanges or unions.

3.4 INSTALLATION

.1 Install to code.

.2 Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install to NACE RP-01-69.

.3 Route piping in orderly manner and maintain gradient.

.4 Install piping to conserve building space and not interfere with use of space.

.5 Group piping whenever practical at common elevations.

.6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

.7 Provide clearance for installation of insulation and access to valves and fittings.

.8 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with the work of other trades.

.9 Establish elevations of buried piping outside the building to ensure not less than 1.0m of cover.

.10 Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

.11 Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. .

.12 Identify piping systems including underground piping.

.13 Install valves with stems upright or horizontal, not inverted.

.14 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.5 TESTING

.1 Test the system(s) in accordance with CAN/CSA B149 and the requirements of the authorities having jurisdiction.

.2 Purge the system(s) after pressure testing in accordance CAN/CSA B149.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 MECHANICAL ELECTRICAL SCHEDULE

.1 The following Mechanical Electrical Schedule is provided to assist the Contractor in co-ordinating the efforts of the sub-trades. The assignment of work among subcontractors is the Contractor's responsibility and the Contractor is free to amend the schedule as they deem necessary.

.2 The Mechanical Electrical Schedule also describes work that is required and may or may not be described elsewhere. All work indicated in the Mechanical Electrical Schedule shall be included in the Bid Price.

.3 The Mechanical Electrical Schedule shall not limit the extent of the Contract in any way. Work indicated elsewhere or otherwise needed for a complete and functioning installation shall be provided whether or not shown in the Mechanical Electrical Schedule.

1.3 RESPONSIBILITY CODES

.1 Responsibility Codes in the Mechanical Electrical Schedule shall be interpreted as follows:

.1 "Supplied by Div.": means that the equipment is to be supplied to the site under the Division described by number.

.2 "Installed by Div.": means that the equipment is to be received from the supplier, handled, set in place and installed at the site under the Division described by number.

.3 "Wired and connected by Div.": means that the equipment and its associated devices are to be wired and connected to the various electrical systems in accordance with the equipment manufacturer's installation instructions and wiring diagrams under the Division described by number.

2 Products

Not Used

3 Execution

3.1 MECHANICAL ELECTRICAL SCHEDULE

.1 Refer to Schedule on next page.

END OF SECTION

MECHANICAL ELECTRICAL COORDINATION SCHEDULE

No.	Equipment				Controls			Responsibility		
	Item	Characteristics		Location	Type	Location	Manufacturer's Reference	Supplied by Div.	Installed by Div.	Wired and Connected by Div.
1	Electronic Trap Seal Primer [TSP-1] & [TSP-2]	Amp	0.28	Mech./Elec. Room & Storage Area	Disconnect	At Panel		26	26	26
		Voltage	120		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
2	Tankless Gas Water Heaters Rack [DWH-1, 2, 3, 4, 5 & 6]	Amp	13.5	Mech./Elec. Room	Disconnect	At Exit Door		26	26	26
		Voltage	120		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
3	Tankless Electric Water Heater [DWH-7]	kW	5.5	Staff Washroom	Disconnect	At Unit		26	26	26
		Voltage	240		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
4	Domestic Hot Water Recirculation Pump [P-1] & [P-7]	HP	1/12	Mech./Elec. Room	Disconnect	At Panel		26	26	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
5	Cistern Chlorination Circulator Pump [P-2]	Watts	55	Mech./Elec. Room	Disconnect	At Panel		26	26	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
6	Chlorination System Dosing Pumps [FIL-1A] & [FIL-1B]	Watts	24	Mech./Elec. Room	Disconnect	At Panel		26	26	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60		Two Chlorine Analyzers			22	22	26
7	Automatic Backwashing Sediment Filter [FIL-2]	Watts		Mech./Elec. Room	Disconnect	At Panel		26	26	26
		Voltage	120		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
8	Ultraviolet Light Filter [FIL-4A] & [FIL-4B]	Watts	100	Mech./Elec. Room	Disconnect	At Panel		26	26	26
		Voltage	120		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
9	Water Closet Flush Valve [W-1], [W-2] & [W-3]	Watts	50	Various Locations	Disconnect	At Panel		26	26	26
		Voltage	120		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60		Transformer			22	26	26
10	Lavatory Faucet [L-1], [L-2] & [L-3]	Amp	20	Various Locations	Disconnect	At Panel		26	26	26
		Voltage	120		Comb. Starter					
		Phases	1		Other Controls	One GFI Receptacle		26	26	26
		Freq.	60		Transformer			22	26	26
11	Shower Valve [SH-1] & [SH-2]	Amp	20	Various Locations	Disconnect	At Panel		26	26	26
		Voltage	120		Other Controls	Electronic Valve Controller & Transformer (two units)		22	22	22
		Phases	1							
		Freq.	60		Solenoid Valve			22	22	22

1 General

1.1 GENERAL REQUIREMENTS

.1 Read and conform to:

.1 Division 01 requirements and documents referred to therein.

.2 Section 23 01 00 applies to and governs the work of all Sections of Divisions 21 Fire Protection, 22 Plumbing and 23 Mechanical.

.3 The technical Sections of this Division are generally divided into units of work for the purpose of ready reference. The division of the work among subcontractors is not the Consultant's responsibility and the Consultant assumes no responsibility to act as an arbiter and/or to establish sub-contract limits between any Sections of the work.

.4 The specifications are integral with the drawings which accompany them. Neither shall be used alone. Any item or subject omitted from one but implied in the other is fully and properly required.

.5 Wherever differences occur in the tender documents, the most onerous condition governs. Base the bid on the most costly arrangement.

1.2 WORK INCLUDED

.1 Products and methods mentioned or shown in the Contract Documents complete with incidentals necessary for a complete operating installation. Provide all tools, equipment and services required to do the work.

.2 Cutting and patching of new or existing work.

.3 Excavating and backfilling.

.4 Identification of equipment, piping, ductwork, and valves and controllers.

.5 Motors required for equipment supplied under this Division.

.6 Variable frequency drives for motors and equipment supplied under this Division.

.7 Internal wiring, relays, contactors, switches, transformers, motor starters, and all controls necessary for the intended operation, furnished with terminals and external controls suitable for connection to power source at a single easily accessed location for equipment items that are supplied with motors and/or electrical or electronic components under this Division.

.8 Disconnect switches for exhaust fans located on the roof complete with;

.1 EEMAC 1 enclosure if housed within a weatherproof cabinet,

.2 EEMAC 3 enclosure if exposed to weather.

.9 Take such measures and include in Bid Price for the proper protection of the existing building and its finishes at all times during alterations and construction of the new addition. Coordinate this protective work with all trades.

.10 Refer to the Mechanical Electrical Coordination Schedule for extent of wiring and electrical characteristics.

.11 Verify the correct operation of each equipment item provided and/or altered and each system in total and obtain the Owner's approval prior to starting and/or returning to operation.

.12 Coordinate with all disciplines.

1.3 RELATED WORK

.1 Power wiring, conduit and connections for motors under this Division will be by Division 26.

.2 Power wiring, conduit and connections to variable frequency drives for motors under this Division will be by Division 26. Wiring and connections from VFD to motors under this Division will be by Division 23.

.3 Flashings for mechanical equipment and services located on or passing through roofs will be provided under Division 7. Supply counter flashings, and integral flashing collars on equipment and piping under this Division.

.4 Painting of exposed piping and ductwork other than for identification will be supplied under Division 09.

.5 Concrete equipment bases, housekeeping pads, sump pits and trenches will be provided under Division 03.

1.4 SUBMITTALS

.1 Submit names of the Commissioning Agent and Balancing Agent to Consultant within one week of award of Contract.

.2 Approval Drawings: Prepare and submit drawings necessary for approval to any authority having jurisdiction, and obtain two (2) copies of approved drawings for retention by the Consultant prior to commencement of work under this Division.

.3 Shop Drawings: Prepare and submit electronic (PDF format) copies of shop drawings of major equipment items, to the Consultant for review. The Consultant will return one copy, marked with comments and review stamp as deemed appropriate. Prepare the necessary number of copies of the returned set and distribute to the Owner, the Prime Consultant, the General Contractor, the site, and to sub-contractors and suppliers.

.1 Clearly indicate the manufacturer's and supplier's names, catalogue model numbers, details of construction, accurate dimensions, capacities and performance. Prior to submission check and certify as correct, shop drawings and data sheets. Do not order equipment until a copy of the shop drawings, reviewed by Consultant, has been returned to Contractor.

.2 Clearly indicate the weight, location, method of support and anchor point forces and locations for each piece of equipment on shop drawings.

.3 The Consultant will not review shop drawings that fail to bear the Contractor's stamp of approval or certification.

.4 Read the following in conjunction with the wording on the shop drawing review stamp applied to each and every drawing submitted;

" The consultant's review will be for conformity to the design concept and for general arrangement only and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the Contract Documents unless a deviation on the shop drawings has been approved in writing by the Consultant."

.4 Contractor's Material and Test Certificates: Prepare and submit certificates for each system installed. Where certificates are prescribed by regulations, codes or standards ensure they conform to the requirements of those documents (eg. NFPA-standards). Include a copy of each certificate in the Operation and Maintenance manual. Certificates shall include the following:

.1 description of the system (description and type),

.2 description of the tests conducted and results observed, including re-testing, where necessary,

.3 description of any corrective measures undertaken,

.4 description of materials used (pipe and fittings),

.5 list of witnesses for each test conducted,

.6 date system left ready for service,

.7 signature of installing Contractor.

.5 Maintenance Data and Operating Instructions

.1 Submit three (3) hard copies and one (1) electronic (PDF format) copy of Operation and Maintenance Manual individually bound in hard backed three-ring binders.

.2 Ensure the binder spines have typewritten lettering as follows:

OPERATION & MAINTENANCE MANUAL

for

[Insert name of project]

[Insert date of submission]

[Insert Division Title]

.3 Provide a list of names, addresses and telephone numbers of equipment suppliers, installing contractors, general contractors, architect and Consultant. Include special telephone numbers for service departments on normal and emergency call basis.

.4 Provide descriptive literature (shop drawings) of each manufactured item. Include a bill of material with purchase order numbers and vendor's identification of equipment orders for each item.

.5 Include copies of start-up reports and checklists and all certificates issued with respect to this contract.

.6 Ensure operating instructions include the following:

.1 General description of each mechanical system.

.2 Step by step procedure to follow in putting each piece of equipment into service.

.3 Schematic control diagrams for each separate mechanical system, control thermometers, freezestats, firestats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control device on these diagrams.

.4 Diagram of the electrical control system indicating the wiring of all related electrical components such as PE and EP switches, firestats, freezestats, fuses, interlocks, electrical switches and relays.

.5 Drawings of each control panel including temperature control and electrical panels, completely identifying all components on the panels and their function.

.7 Ensure maintenance instructions include the following:

.1 Manufacturer's maintenance instructions for each item of mechanical equipment installed under this Division. Instructions shall include installation instructions, parts numbers and lists, name of supplier and maintenance and lubrication instructions.

.2 Summary list of each item of mechanical equipment requiring lubrication, indicating the name of the equipment item, location of all points of lubrication, type of lubricant recommended, and frequency of lubrication.

.3 Equipment directory indicating name, model, serial number and nameplate data of each item of equipment supplied, and system with which it is associated.

.4 Balancing and testing reports.

.5 Copy of valve directory.

1.5 QUALITY ASSURANCE

.1 Conform to the minimum requirements or better of provincial and local codes, where existing, and to the requirements of local inspection authorities for execution of work under this Division.

.2 Ensure materials supplied under this Division conform to minimum requirements and recommendations or better of applicable standards of the following:

.1 AABC Associated Air Balance Council

.2 AMCA Air Moving and Conditioning Association

.3 ANSI American National Standards Institute

.4 ASA American Standards Association

.5 ASHRAE American Society of Heating, Refrigerating, and Air Conditioning Engineers

.6 ASME American Society of Mechanical Engineers

.7 ASSE American Society of Sanitary Engineers

.8 ASPE American Society of Plumbing Engineers

.9 ASTM American Society of Testing and Materials

.10 AWWA American Water Works Association

.11 CAN2 National Standard of Canada (Published by CGSB)

.12 CAN3 National Standard of Canada (Published by CSA)

.13 CGSB Canadian General Standards Board

.14 CSA Canadian Standards Association

.15 EEMAC Electrical & Electronic Manufacturer's Association of Canada

.16 NBC National Building Code of Canada

.17 NEBB National Environmental Balancing Bureau

.18 NFPA National Fire Protection Association

.19 NEMA National Electrical Manufacturers Association

.20 OBC Ontario Building Code

.21 OFC Ontario Fire Code

.22 OFM Ontario Fire Marshall

.23 SMACNA Sheet Metal & Air Conditioning Contractors National Association

.24 TIAC Thermal Insulation Association of Canada

.25 ULC Underwriter's Laboratories of Canada Ltd

.26 UL Underwriter's Laboratories (including cUL)

.3 Use latest editions and amendments in effect on date of Bid call subject to requirements of OBC.

.4 Arrange and pay for permits and inspections by authorities having jurisdiction, required in the undertaking of this Division. Make modifications required by authorities.

.5 All tradesmen employed on the project shall hold valid trade certificates/licenses and shall make a copy available for review by the Consultant and/or Owner when requested.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

.1 Immediately after letting of contract, review material and equipment requirements for this work, determine supply and delivery dates for all items, and notify Consultant of any potential delays in completion of this project in order that remedial action may be taken.

.2 Store neatly out of the way and protected from damage and theft, materials and equipment supplied under this Division that are received at the site by this Division.

1.7 JOB CONDITIONS

.1 Visit site and examine existing conditions which may affect work of this Division.

.2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.

.3 Notify Consultant upon discovery of conditions which adversely affect work of this division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.

.4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.8 WARRANTY

.1 Refer to General Conditions. Arrange with each manufacturer/supplier to extend warranties as necessary to coincide with warranty period or those periods specified.

.2 Make submissions necessary to register product warranties to the benefit of the Owner.

.3 Submit to Consultant, prior to Substantial Performance of the Contract, manufacturer's written warranties covering periods longer than one year or offering greater benefits than required in specifications and in the Owner's name.

1.9 DEFINITIONS

.1 The following are definitions of words found in this specification and on associated drawings under this Division:

.1 "Concealed" - hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, and partitions.

.2 "Exposed" - mechanical work normally visible to building occupants.

.3 "Provide" - (and all tenses of "provide") - supply, install and connect complete.

.4 "Install" - (and all tenses of 'install") - install and connect complete, products and services specified.

.5 "Supply" - supply to site in location determined by Owner.

.6 "Wet" - wet areas requiring special materials.

1.10 INTERRUPTIONS

.1 Arrange execution of work to maintain present building operations, and to minimize the effect of work under this Division on existing operations.

.2 Prior to interrupting any existing service notify the Owner and Consultant, in writing, at least 7 days in advance, and obtain written authorization. Do not interrupt any existing service without the Consultant's specific authorization.

.3 Arrange time and duration of interruption through the Owner's representative(s). Include in Bid Price for all overtime or premium time hours necessary to minimize duration of service interruption.

.4 Test and verify the proper operation of existing equipment and systems that are shut down due to work of this project, prior to returning to service.

.5 Assume responsibility for consequential costs on failure to obtain permission to shut-down and/or start-up any item of equipment, system or service.

2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Ensure materials and equipment provided under this Division are new and free from defects and bear labels of approval as required by codes referred to in this Division and/or by inspection authorities.

.2 Ensure apparatus and equipment provided under this Division bears manufacturer's nameplate indicating name of manufacturer, model number or type, size, capacity, CRN, and other pertinent information. Ensure nameplates are easily read and clearly visible, with openings provided where equipment is insulated.

.3 Ensure manufacturers and suppliers of equipment or materials under this Division determine if their products are composed of any hazardous materials. If they are, the products are suitably labelled and supplied with Material Safety Data sheets. Obtain the Owner's approval in writing to bring hazardous materials onto the site prior to doing so.

.4 When utilizing any products that are hazardous, keep Material Safety Data sheets on file at the job site and present them to anyone requesting this information. When transferring hazardous materials from original container into other containers, provide Workplace Labels on such containers.

2.2 ACCEPTABLE PRODUCTS

.1 First item named or specified by catalogue number meets specifications regarding performance, quality of material and workmanship, and is acceptable to the Consultant.

.2 Items, other than first named, meeting specifications regarding quality of materials and workmanship are acceptable to the Consultant, only, if they also meet performance and/or capacities specified and can be accommodated within the space allotted.

.3 General approval indicated by inclusion of other manufacturers named is subject to final review of shop drawings, performance data and test reports.

2.3 EQUIVALENTS AND ALTERNATIVES

.1 Suppliers wishing approval for additional equipment items as equivalent to those specified must submit a complete description, technical and performance data to Consultant at least ten (10) working days prior to Bid closing date. Such equivalent equipment, if accepted, to conform to specifications with regard to all details, accessories, modifications, features and performance. Deviations from specifications must be stated in writing at time of submission for approval.

.2 Bid Prices shall include only products specified or approved equivalents. Contractors may propose unsolicited alternatives to the products specified. Alternative proposals shall be submitted in sealed envelope at time of general contract Bid submission and shall include full description and technical data, and a statement of the related increase or decrease in Bid Price should alternatives be accepted. All additional costs associated with unsolicited alternative proposals such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. Shall be included in the alternative price. Prior approval by Consultant is not required for unsolicited alternative proposals.

.3 Where the Contractor uses equipment other than that first named, on which the design is based, they shall be responsible for all details of installation including equipment size, arrangement, fit, and maintenance of all required clearances. Contractor shall prepare and submit revised layouts to indicate arrangement of all affected piping, ductwork, conduit, lighting, equipment, etc. Failure by Contractor to provide such drawings will be considered indication that original arrangements and space allocations are adequate. All additional costs associated with equivalent equipment such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in Bid Price.

2.4 SUBSTITUTIONS DURING PROGRESS OF WORK

.1 If during the progress of work, specified products are not obtainable, equivalent or similar products by other manufacturers may be permitted by the Consultant.

.2 Apply, in writing, to Consultant for substitution of any products, indicating the following:

.1 Manufacturer's name, model number, details of construction, accurate dimensions, capacities and performance of proposed products.

.2 Reason for substitution.

.3 Any revisions to the contract price made necessary by substitution and shall include an itemized break down.

.4 Any revisions to the contract time made necessary by substitution.

.5 Any revisions to layout, arrangement or services made necessary by substitution.

.3 No substitutions will be permitted without written authorization from the Consultant.

2.5 CONSULTANT'S REVIEW

.1 The consultant will review and evaluate unsolicited alternatives and substitutions proposed by the Contractor. Such review and evaluation work will be undertaken by the Consultant on an additional fee basis. The Contractor shall reimburse the Owner for all costs associated with such reviews and evaluations.

.2 The Contractor shall also reimburse the Owner for any and all costs incurred in updating Contract Documents to reflect such changes.

3 Execution

3.1 RELATIONSHIP WITH OTHER TRADES

.1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.

.2 Provide materials to be built-in, such as sleeves, anchors, and inserts, together with templates and/or measurements, promptly when required by other trades.

.3 Provide structural supports for equipment to be mounted on or in walls, supported above floors and/or suspended from the structure.

3.2 INSTALLATION REQUIREMENTS

.1 The Consultant's drawings and instructions govern the location of all items. Prepare fully coordinated installation drawings prior to installation.

.2 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise install products and services to follow building planes. Ensure installation permits free use of space and maximum headroom.

.3 Confirm the exact location of outlets, fixtures and connections. Confirm location of outlets for equipment supplied under other Divisions.

.4 Install equipment and apparatus to allow free access for maintenance, adjustment and eventual replacement.

.5 Install metering and/or sensing devices to provide proper and reliable sampling of quantities being measured. Install instruments to permit easy observation.

.6 Provide suitable shielding and physical protection for devices.

.7 Install products and services in accordance with the manufacturer's requirements and/or recommendations.

.8 Provide bases, supports, hangers and fasteners. Secure products and services so as not to impose undue stresses on the structure and systems.

.9 Do not use power activated tools without written permission of the Consultant. Use them in accordance with the Owner's health and safety policies.

.10 Ensure that the load onto structures does not exceed the maximum loading indicated on the structural drawings or as directed by the Consultant.

3.3 CONTRACT DRAWINGS

.1 The drawings of this Division are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.

.2 Obtain accurate dimensions from the architectural and structural drawings, or by field measurement. Location and elevation of services are approximate. Verify them before construction is undertaken.

.3 Make changes, where required to accommodate structural conditions. Obtain Consultant's approval before proceeding.

.4 Adjust the location of materials and/or equipment as directed without adjustment to contract price, provided that the changes are requested before installation and do not affect material quantity. Outlets and/or equipment may be relocated up to 10 feet (3 m) in any direction without a change to the contract price.

.5 Note that the layout and orientation of the ceiling outlets on the architectural reflected ceiling plan drawings may differ from that shown on the mechanical drawings. Make the installation in accordance with the latest architectural reflected ceiling plans. Provide the equipment as specified and/or shown on the documents of this Division.

.6 The drawings of this Division are intended for tender pricing. The quantities and quality to be included in the bid price shall be based on the layout and specifications as indicated in the mechanical documents. If there is a difference in quantity between the architectural and drawings of this Division, base the contract price on the greater quantity.

.7 Prepare installation drawings to reflect the latest architectural ceiling layout.

3.4 RECORD DRAWINGS

.1 Maintain project "as-built" record drawings. Obtain white prints from the Consultant for this purpose and pay printing costs. Identify each set as "Project Record Copy".

.2 Record deviations from contract documents caused by site conditions or by addendums, site instructions and/or changes orders. Record deviations in red ink clearly and accurately, using industry standard drafting procedures consistent with quality and standards of Consultants documents.

.3 Record deviations as work progresses throughout the execution of this contract. Maintain record drawings on site in clean, dry, legible condition, making them available for periodic review by the Consultant.

.4 Record the location of concealed services, particularly underground services. Before commencing any backfilling, obtain accurate measurements and information concerning correct location and depth of services.

.5 Transfer records from the "Project Record Copy" to a DVD in Autocad format matching the Consultant's documents. Arrange computer file in layers to exactly match the layering system of the Consultant.

.6 Submit the "Project Record Copy" on one (1) or more DVD’s with white prints of each drawing to the Consultant at the time of Substantial Performance.

3.5 USE OF EQUIPMENT

.1 For the duration of this contract, do not use any piece of equipment provided under this contract for the purposes of heating, ventilation or air conditioning without the specific authorization of the

Owner and Consultant. Ensure the building is "broom clean" and painting is finished before asking permission for testing to commence.

.2 specific written authorization is given for the use of equipment while work is still in progress, seal off ductwork, grilles, diffusers, and registers or other openings to the air distribution system(s) or air handling equipment that is not in use. Provide filters over openings in ductwork, over grilles, diffusers and registers and in or at any air handling equipment that is in use. Ensure that the edges are sealed so that the filters are not bypassed. Change the filters frequently, to the satisfaction of the Consultant, until the building is turned over the Owner.

3.6 SPECIAL TOOLS & SPARE PARTS

.1 Within 30 days of award of contract, prepare a complete itemized list of special tools and spare parts and submit to Consultant for review. List will be used as a checklist and should include provision for sign off by the Owner on receipt.

.2 On completion of the project furnish spare parts to the Owner as follows:

.1 One set of mechanical seals for each pump.

.2 One casing joint gasket for each pump.

.3 One glass for each gauge glass installed.

.4 One set of v-belts for each piece of machinery.

.3 Identify spare parts containers as to contents and replacement parts number.

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

.5 Furnish one grease gun and adaptors to suit different types of grease and fittings.

3.7 PAYMENT BREAKDOWN

.1 After award of Contract, submit an itemized payment and breakdown showing the installed cost with material and labour component breakdown indicated separately for each of the major work items listed below. The payment breakdown shall be subject to the approval of the Consultant. No progress payment approvals will be processed until an approved payment schedules in place.

.2 Payment breakdown shall be as follows:

.1 General

.1 Mobilization and Insurance

.2 Project supervision

.3 Shop drawings

.4 Balancing and commissioning

.5 Project record drawings and manuals

.6 Instructions to Owner's personnel

.2 Plumbing and Drainage

.1 Underground and under floor piping

.2 Above ground piping

.3 Valves, specialties, roof and floor drains

.4 Electronic trap priming manifolds

.5 Plumbing fixtures

.6 Insulation

.3 Heating, Ventilating and Air Conditioning

.1 Boilers

.2 HRVs and Fans

.3 Grilles, diffusers, registers

.4 Insulation

.4 Fire Protection

.1 Portable fire extinguishers

.5 Site Services

.1 Manholes

.2 Chambers

.3 Sanitary sewers

.4 Water Mains

.5 Chlorination and flushing

3.8 EXTRAS AND CREDITS

.1 Accompany all price submissions requested by Consultant for extra work, or work to be deleted, with a complete cost breakdown as follows:

.1 Materials, quantities and unit costs including any applicable contractor’s trade discount clearly identified.

.2 Labour hours and unit costs.

.3 Total materials and labour costs.

.4 Overhead and profit mark-ups in accordance with the General Conditions of the Contract.

3.9 INSTRUCTIONS

.1 Instruct and familiarize the Owner's operating personnel with the various mechanical systems. Arrange instruction for each system separately.

.2 Provide instruction for each system on two separate occasions, coordinated with the Owner's staff operating schedule, in order that interested personnel may arrange to attend.

.3 Ensure each instruction period includes, but is not limited to the following;

.1 Classroom seminar with operating manuals, product and system drawings and such other audio/visual aids as may be appropriate,

.2 Instruction during the classroom seminar by the manufacturer's representative regarding the proper operating and maintenance procedures for each item of equipment,

.3 Demonstration of the proper operating procedures for each item of equipment,

.4 Explanation of the purpose and function of all safety devices provided, and

.5 Demonstration of all measures required for safe and proper access for operation and maintenance.

.4 Provide a period of follow-up instruction approximately one month after completing the Owner's instruction to clarify and reinforce earlier instructions.

.5 Submit a letter from the Owner's management staff indicating the instruction has been given satisfactorily to the Consultant prior to substantial completion of the project.

3.10 COMMISSIONING

.1 The Contractor shall start-up and completely commission all equipment and systems installed and/or modified under this contract. Commissioning work shall be completed to the satisfaction of the Consultant prior to acceptance of the Work or any part thereof.

.2 The Commissioning Team shall be comprised of:

.1 Commissioning Agent

.2 The individual, company or agency undertaking the work of each Section,

.3 Representatives of the Contractor and his sub-contractors as required,

.4 Representatives of equipment manufacturers,

.5 Representatives of the Consultants,

.3 The Contractor and his sub-contractors shall each assign an individual representing each of the relevant trades to the commissioning team and shall ensure that representatives of the equipment manufacturers are present during the relevant commissioning tasks.

.4 The Contractor shall provide all necessary labour, materials, equipment, testing apparatus and incidentals necessary to completely start-up, verify, test and commission each system provided as part of the Work.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.1 SECTION INCLUDES

.1 Testing, adjustment, and balancing of air systems.

.2 Testing, adjustment, and balancing of hydronic and steam systems.

.3 Sound measurement of equipment operating conditions.

.4 Vibration measurement of equipment operating conditions.

1.2 SEQUENCING

.1 Convene a minimum of one (1) week prior to commencing the scope of work of this Section.

.2 Sequence work to commence after completion of the systems. Schedule completion of work before Substantial Completion of Project.

1.3 SCHEDULING

.1 Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

1.4 COORDINATION

.1 Cooperate with the installing Contractor(s) in advising them of specific scheduling requirements for systems verification.

.2 Provide advice to the installing Contractor(s) regarding the location and installation of devices required to permit system balancing and measurements, prior to start of the installation work.

1.5 SUBMITTALS

.1 Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.

.2 Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

.3 Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

.4 Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Consultant and for inclusion in operating and maintenance manuals.

.5 Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side.

.6 Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

.7 Test Reports: Indicate data on AABC National Standards for Total System Balance forms. Submit data in S.I. Metric units.

.8 All reports shall be prepared in electronic (computer) format using MS Word software and all tabulations shall be prepared in electronic (computer) format using MS Excel spreadsheet software. Submittals shall include three (3) copies each of hard copy printout and electronic copy (CD/DVD/USB Drive).

1.6 QUALITY ASSURANCE

.1 Perform total system balance to AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

.2 Maintain one copy of each document on site.

1.7 REFERENCES

.1 Ontario Building Code and national Building Code.

.2 Ontario Fire Code.

.3 AABC - National Standards for Total System Balance.

.4 ACG - AABC Commissioning Guideline.

.5 ADC - Test Code for Grilles, Registers, and Diffusers.

.6 ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

.7 ASHRAE Guideline 0 The Commissioning Process,

.8 ASHRAE Guideline 1 The HVAC Commissioning Process,

.9 ASHRAE Guideline 1.1 HVAC&R Technical Requirements for the Commissioning Process,

.10 ASHRAE Guideline 5 Commissioning Smoke Management Systems

.11 ASTM E779 Determining Air Leakage Rate by Fan Pressurization.

.12 NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

.13 SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

.14 SMACNA HVAC Systems Commissioning Manual,

1.8 QUALIFICATIONS

.1 Agency: Company specializing in the testing, adjusting, and balancing of systems under this Section with minimum five years documented experience certified by AABC.

.2 Work shall be performed under the supervision of an AABC certified Test and Balance Engineer, an NEBB Certified Testing, Adjusting and Balancing Supervisor or a registered Professional Engineer experienced in the performance of this work and licensed at the place where the Project is located.

2 Products

2.1 REFERENCE STANDARDS

.1 All equipment required for the verification of equipment and systems shall be furnished by the agency employed to conduct the Mechanical Systems Verification.

.2 Testing and measuring equipment used in the verification of the mechanical systems shall be calibrated to give true readings within the accuracy specifications of the equipment used. A certificate of calibration from an independent testing laboratory may be required by the Consultant if there is any reason to suspect that the equipment used is giving erroneous readings. In such an event the verification agency shall re-conduct its verifications.

.3 All equipment used by the agency in its verification of mechanical systems remains the property/responsibility of the agency and is not included in the supply to the project.

3 Execution

3.1 EXAMINATION

.1 Verify that systems are complete and operable before commencing work. Ensure the following conditions:

.1 Systems are started and operating in a safe and normal condition.

.2 Temperature control systems are installed complete and operable.

.3 Proper thermal overload protection is in place for electrical equipment.

.4 Final filters are clean and in place. If required, install temporary media in addition to final filters.

.5 Duct systems are clean of debris.

.6 Fans are rotating correctly.

.7 Fire and volume dampers are in place and open.

.8 Air coil fins are cleaned and combed.

.9 Access doors are closed and duct end caps are in place.

.10 Air outlets are installed and connected.

.11 Duct system leakage is minimized.

.12 Hydronic systems are flushed, filled, and vented.

.13 Pumps are rotating correctly.

.14 Proper strainer baskets are clean and in place.

.15 Service and balance valves are open.

.2 Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

.3 Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

.1 Prepare a TAB Plan that includes strategies and step by step procedures.

.2 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.3 Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

.1 Prepare test reports for both fans and outlets.

.2 Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

.3 Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

.4 Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

.1 Ensure recorded data represents actual measured or observed conditions.

.2 Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

.3 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

.4 Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

.5 At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

.6 Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

.1 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

.2 Make air quantity measurements in ducts by pitot tube traverse of entire cross sectional area of duct.

.3 Measure air quantities at air inlets and outlets.

.4 Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

.5 Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

.6 Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

.7 Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

.8 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan.

.9 Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

.10 Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

.11 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

.12 Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05in.wg. (12.5Pa) positive static pressure near the building entries.

3.6 WATER SYSTEM PROCEDURE

.1 Adjust water systems at all points to provide required or design quantities.

.2 Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

.3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

.4 Effect system balance with automatic control valves fully open to heat transfer elements.

.5 Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

.6 Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 SCHEDULES

.1 Equipment requiring testing, adjusting and balancing:

- .1 Boilers
- .2 Plumbing Pumps
- .3 HVAC Pumps
- .4 In-Floor Heating system and Manifolds
- .5 Air Coils
- .6 Terminal Heat Transfer Unit
- .7 HRV units and Fans
- .8 Air Terminal Units
- .9 Air Inlets and Outlets

.2 Report Forms

- .1 Title Page:
  - .1 Name of Testing, Adjusting, and Balancing Agency
  - .2 Address of Testing, Adjusting, and Balancing Agency
  - .3 Telephone number of Testing, Adjusting, and Balancing Agency
  - .4 Project name
  - .5 Project location
  - .6 Project Architect
  - .7 Project Engineer
  - .8 Project Contractor
  - .9 Project altitude
  - .10 Report date
- .2 Summary Comments:
  - .1 Design versus final performance
  - .2 Notable characteristics of system
  - .3 Description of systems operation sequence
  - .4 Summary of outdoor and exhaust flows to indicate amount of building pressurization
  - .5 Nomenclature used throughout report
  - .6 Test conditions
- .3 Instrument List:
  - .1 Instrument
  - .2 Manufacturer
  - .3 Model number
  - .4 Serial number
  - .5 Range
  - .6 Calibration date

.4 Electric Motors:

.1 Manufacturer

.2 Model/Frame

.3 HP/BHP

.4 Phase, voltage, amperage; nameplate, actual, no load

.5 RPM

.6 Service factor

.7 Starter size, rating, heater elements

.8 Sheave Make/Size/Bore

.5 V-Belt Drive:

.1 Identification/location

.2 Required driven RPM

.3 Driven sheave, diameter and RPM

.4 Belt, size and quantity

.5 Motor sheave diameter and RPM

.6 Centre to centre distance, maximum, minimum, and actual

.6 Pump Data:

.1 Identification/number

.2 Manufacturer

.3 Size/model

.4 Impeller

.5 Service

.6 Design flow rate, pressure drop, BHP

.7 Actual flow rate, pressure drop, BHP

.8 Discharge pressure

.9 Suction pressure

.10 Total operating head pressure

.11 Shut off, discharge and suction pressures

.12 Shut off, total head pressure

.7 Heating Coil Data:

.1 Identification/number

.2 Location

.3 Service

.4 Manufacturer

.5 Air flow, design and actual

.6 Water flow, design and actual

.7 Water pressure drop, design and actual

.8 Entering water temperature, design and actual

.9 Leaving water temperature, design and actual

.10 Entering air temperature, design and actual

.11 Leaving air temperature, design and actual

.12 Air pressure drop, design and actual

.8 Air Moving Equipment (HRV Units)

.1 Location

.2 Manufacturer

.3 Model number

.4 Serial number

.5 Arrangement/Class/Discharge

.6 Air flow, specified and actual

.7 .Return air flow, specified and actual

.8 Outside air flow, specified and actual

.9 Total static pressure (total external), specified and actual

.10 Inlet pressure

.11 Discharge pressure

.12 Sheave Make/Size/Bore

.13 Number of Belts/Make/Size

.14 Fan RPM

.9 Exhaust Fan Data:

.1 Location

.2 Manufacturer

.3 Model number

.4 Serial number

.5 Air flow, specified and actual

.6 Total static pressure (total external), specified and actual

.7 Inlet pressure

.8 Discharge pressure

.9 Sheave Make/Size/Bore

.10 Number of Belts/Make/Size

.11 Fan RPM

.10 Duct Traverse:

.1 System zone/branch

.2 Duct size

.3 Area

.4 Design velocity

.5 Design air flow

.6 Test velocity

.7 Test air flow

.8 Duct static pressure

.9 Air temperature

.10 Air correction factor

.11 Duct Leak Test:

.1 Description of ductwork under test

.2 Duct design operating pressure

.3 Duct design test static pressure

.4 Duct capacity, air flow

.5 Maximum allowable leakage duct capacity times leak factor

.6 Test apparatus

.1 Blower

.2 Orifice, tube size

.3 Orifice size

.4 Calibrated

.7 Test static pressure

.8 Test orifice differential pressure

.9 Leakage

.12 Air Distribution Test Sheet:

.1 Air terminal number

.2 Room number/location

.3 Terminal type

.4 Terminal size

.5 Area factor

.6 Design velocity

.7 Design air flow

.8 Test (final) velocity

.9 Test (final) air flow

.10 Percent of design air flow

.13 Sound Level Report:

.1 Location

.2 Octave bands - equipment off

.3 Octave bands - equipment on

.14 Vibration Test:

.1 Location of points:

.1 Fan bearing, drive end

.2 Fan bearing, opposite end

.3 Motor bearing, centre (if applicable)

.4 Motor bearing, drive end

.5 Motor bearing, opposite end

.6 Casing (bottom or top)

.7 Casing (side)

.8 Duct after flexible connection (discharge)

.9 Duct after flexible connection (suction)

.2 Test readings:

.1 Horizontal, velocity and displacement

.2 Vertical, velocity and displacement

.3 Axial, velocity and displacement

.3 Normally acceptable readings, velocity and acceleration

.4 Unusual conditions at time of test

.5 Vibration source (if non-complying)

3.8 VERIFICATION CHECKLIST

.1 Prepare a series of checklists to record the verification of each item of equipment and each system. Submit a draft of each checklist to the Consultant and the Owner for review and approval. Discuss comments offered the Consultant and Owner and include improvements as directed.

.2 Checklists shall include the following as a minimum;

.1 a record of the nameplate data for each equipment item and each associated motor,

.2 a list of observations appropriate to the equipment item or system with space adjacent to indicate whether the item was satisfactory or unsatisfactory,

.3 a list of observations appropriate to the equipment item or system with space adjacent to indicate whether the item was satisfactory or unsatisfactory,

.4 appropriate space for recording comments and/or instructions given during observations.

3.9 EQUIPMENT VERIFICATION

.1 Test the operation of all equipment installed under Division 23 according to instructions in appropriate articles of this Division. Advise installing contractor of any required adjustments or replacements to ensure that equipment is operating as intended. Retest equipment after adjustment or replacement.

.2 Ensure that the Contractor has given proper advance notification to all persons required to be present as tests are conducted. Refer to 23 10 00.

.3 Instrumentation: verify installation of air filter gauges, pumps, thermometers, thermometer wells, pitot traverse stations, and flow-measuring devices ensuring that:

.1 Location of points for readings is appropriate to measure what it is intended to measure;

.2 The scale range is appropriate to place the normal reading near mid-range of the scale;

.3 Proper positioning of instrumentation to allow reading from a convenient location, and for easy access.

.4 Filters Inspection: visually inspect each filter installation. Verify adjustment of latching devices, installation of end spacers in filter boxes, and proper latching and sealing of access doors. Verify the installation of new (clean) filter media after Contractor's start-up procedures.

.5 Pre-start-up Inspection:

.1 Verify proper equipment mounting and setting.

.2 Verify that control, interlock, and power wiring are complete.

.3 Verify proper alignment of motors and drives.

.4 Verify proper piping connections and accessories.

.5 Verify that lubrication is complete.

.6 First Run Observation:

.1 Verify direction of rotation.

.2 Verify setting of safety controls.

.3 Monitor heat build-up in bearings.

.4 Check motor loads against nameplate ratings.

.7 Equipment Checkout:

.1 Verify the proper overload heater sizes.

.2 Verify function of safety and operating controls.

.3 Verify proper operation of equipment.

.4 Report on inspection, observation, and checkout procedures.

.8 Stuffing Boxes and Packing Glands: verify adjustment of boxes on pump shafts and packing glands on valve stems.

.9 Motor Rotation: visually inspect and verify the direction of motor rotation. It is possible for motor rotation to have been checked by the electrician when power connections were made on temporary electric power, then when final connections were made to the permanent transformer bank, crossed phasing may reverse the rotation of all three-phase motors on the system.

.10 Overload Heaters: verify supply voltage to each equipment. If the applied voltage is different from the motor nameplate, determine whether the applied voltage is within the range allowed under the motor guarantee. If not, take the necessary action to have the Contractor change the motor or the applied voltage. When the voltage is off the nameplate value, but within the allowable range, compute the equivalent amperage at nameplate voltage and compare to the overload heater amperage rating range. Then, consider whether the ambient temperature of the starter is above, below, or the same as the ambient temperature are not the same. Advise the Contractor to use overload heaters of higher range for "hot area" starters or ones of lower range for "cold area" starters to compensate the heater trip point for heat gains or losses with the environment.

.11 Alignment of Drives: verify the alignment of drives, belt and direct coupled, and the adjustment of belt tension.

.12 Control Diagrams and Sequences: provide for coordination with work under the automatic control systems to have the control diagrams and sequences of operation corrected to "as installed", reflecting changes brought about in response to contract modifications and to the more pragmatic changes in diagrams and sequences to make the installed system control the building systems as intended by the designer.

.13 Safety and Operating Control Setpoints: systematically verify the safety and operating controls of equipment, including an operational check of associated control sequences.

.14 Fin Straightening: inspect finned surface heat transfer coils for damages fins and advise Contractor of repairs required.

.15 Verify that manufacturer's start-up procedures have been performed and that equipment is installed in accordance with the manufacturer's written installation recommendations.

.16 Where work is noted to be done in stages a complete air balance and verification report will be required at the end of each stage.

3.10 PIPING SYSTEMS VERIFICATION

.1 Review the drawings, specifications, and installed work to ensure that systems may be properly balanced in accordance with drawings. Advise the installing Contractor of any additional requirements for effective balancing.

.2 Complete air balancing must have been accomplished before water balance is verified.

.3 Open all valves to full position, including coil stop valves, close bypass valves, and return line balancing cocks.

.4 Verify that all strainers are clean.

.5 Examine water in system to determine if it has been treated and is clean.

.6 Check and record type and concentration of glycol in systems which require freeze protection.

.7 Check pump rotation.

.8 Check diaphragm expansion tanks to ensure that fill pressure is adequate (re. static head of systems plus 5psig or 12psig minimum (35kPa or 83kPa minimum).

.9 Check open expansion tanks to make sure they are not air bound and that the system is full of water.

.10 Check all air vents at high points of water systems to make sure they are installed properly and are operating freely. Verify that all air is removed from circulating system.

.11 Set all temperature controls so that all coils are calling for full cooling. This should close all automatic bypass valves at coil and chillers. To balance hot water coils, set systems to call for full heating.

.12 Verify operation of automatic bypass valve.

.13 Verify operating temperature of heat exchangers, to design requirements.

.14 Check and record the following items at each cooling and heating element:

.1 Inlet water and air temperatures. Note rise or drop in temperature train source.

.2 Leaving water and air temperatures.

.3 Pressure drop and flow through each coil.

.4 Pump operating suction and discharge pressure and final total dynamic head and flow are delivered.

.5 Pressure drop across bypass valve.

.6 All mechanical specifications of pumps.

.7 Rated and actual running amperage of pump motor.

.15 Witness all piping tests.

3.11 AIR SYSTEM VERIFICATION

.1 Review drawings, specifications and installed work to ensure that systems may be properly balanced in accordance with drawings. Advise installing Contractor of any additional requirements for effective balancing.

.2 In air handling systems which include supply fans with variable speed drives, airflows shall be verified to design with all filters clean and with all filters loaded to filter manufacturer's recommended final (change-out) resistance. Motor and drive capacity to accommodate full range of filter loadings shall be verified.

.3 In air handling systems which include supply fans without variable speed drives, air filters shall be verified to design airflows with air filters loaded so that the air pressure drop through each filter is equal to the average of the manufacturers listed initial resistance and recommended final resistance.

.4 Test and record blower rpm for each fan and air handling unit.

.5 Test and record motor full load amperes.

.6 Make Pitot tube traverse of main supply and obtain operating air quantities at fans.

.7 Test and record system static pressures, suction and discharge.

.8 Test and record system operating re-circulated air quantities.

.9 Test and record system operating outside air quantities.

.10 Test and record entering dry bulb air temperatures (heating and cooling coils).

.11 Test and record entering wet bulb air temperatures (heating and cooling coils).

.12 Test and record leaving dry bulb air temperatures (heating and cooling coils).

.13 Test and record leaving wet bulb air temperatures (cooling coils only).

.14 Measure airflow in all main and zone branch supply and return air ducts.

.15 Test and record airflow at each diffuser, grille, and register.

.16 Witness and verify results of duct leakage tests conducted under section 23 81 00.

.17 Tabulate and certify test results on suitable forms and submit Consultant for approval and record. Identity each diffuser, grille, and register as to location and area. Identify and list size, type, and manufacturer of diffusers, grilles, registers, and all testing equipment. Use manufacturer's rating on all equipment to make required calculations.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00.

.2 Division 01 requirements and documents referred to therein.

1.2 COMMON WORK RESULTS

.1 Section 23 10 00 applies to and governs all work of Divisions 21 Fire Protection, 22 Plumbing and 23 Mechanical.

1.3 REFERENCES

.1 Provide all work in accordance with requirements of Regulatory Agencies and conform to:

.1 Local and district by-laws, regulations and published engineering standards.

.2 the Ontario Building Code as amended

.3 Regulations for Construction Projects under The Occupational Health and Safety Act.

.4 Fire Code made under the Fire Marshal's Act.

.2 Conform to following CSA Standards:

.1 CSA B64.1 Manual for the Selection and Installation of Backflow Prevention Devices

.2 CSA B64.1 Manual for the Maintenance and Field Testing of Backflow Prevention Devices.

.3 CAN1-B149.1 Natural gas and propane installation code.

.3 Conform to following National Research Council Canada publications:

.1 National Building Code of Canada and Supplements to National Building Code of Canada

.2 National Fire Code of Canada.

.3 Canadian Plumbing Code.

.4 Provide work where indicated in conformance with guide Specification of the Victaulic System for Building Services, G-100.

.5 The above documents or portions thereof are referenced within the work of Divisions 21 - Fire Protection, 22 – Plumbing and Drainage and 23 – Mechanical and shall be considered part of the requirements of this document as though fully repeated herein.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 23 01 00, for the following items:

.1 piping specialties

2 Products

2.1 PIPING SPECIALTIES

.1 Cast brass, pressure, copper to copper unions shall be used with seamless copper tubing smaller than 3" (75mm).

.2 Piping specialties including backflow preventers, strainers, valves etc. shall be line size unless indicated otherwise on drawings.

.3 Strainers

.1 Manufacturers: Sarco SB, S. A. Armstrong, Crane, Conbraco and Colton

.2 In copper tubing: Class 250, wye type, bronze, screwed connection, with blind caps, and 1/32" (0.8mm) perforated stainless steel screen.

.3 In Steel Piping: 2" (50mm) and smaller:

.1 Body and cover: screwed, line size Y type strainer, semi-steel conforming to ASTM A278-85, Class 30, complete with screwed blind cap. Primary service rating of 125psi @ 350F (860kPa @ 178C). Body shall have side drain connection.

.2 Screen: perforated type 304 stainless steel service: Steam 1/16" (0.4mm), Water 1/32" (0.8mm), Glycol 1/32" (0.8mm), Water @ Pump Suction 1/8" (3.2mm), Light Oil 1/16" (1.6mm,) Compressed Air 1/64" (0.4mm).

2.2 ADHESIVES, SEALANTS, PAINTS AND COATINGS

.1 Adhesives, Sealants, Paints and Coatings: Use only low VOC emitting materials meeting following criteria;

.1 Paint for Mechanical Identification: maximum VOC emission of 250g/L

.2 Touch-Up Paint: maximum VOC emission of 250g/L

.3 Zinc-Rich Primer: maximum VOC emission of 250g/L

.4 Adhesives for Mechanical Identification: maximum VOC emission of 70g/L

.5 Sealants for service penetrations: maximum VOC emission of 650g/L clear and 350g/L pigmented

.6 Sealants for Firestopping: max. VOC emission of 650g/L clear and 350g/L pigmented.

.7 Acrylic Sealant for supports and anchors: maximum VOC emission of 250g/L

.8 Insulation Vapour Barrier Lap Adhesive: maximum VOC emission of 80g/L

.9 Insulation Joint Sealer: maximum VOC emission of 250g/L

.10 Insulation Vapour Barrier Mastic: maximum VOC emission of 400g/L

.11 Flame Retardent Adhesive: maximum VOC emission of 650g/L clear and 350g/L pigmented

3 Execution

3.1 INSPECTION

.1 Inspect installed work of other trades and verify that such work is complete to point where work under this Division may properly commence.

.2 Verify that work of this Division may be executed in accordance with pertinent codes and regulations, specifications, drawings, and referenced standards.

.3 Review drawings and verify dimensions at the site. Report discrepancies immediately to Consultant before proceeding with any construction work or shop drawings.

3.2 PREPARATION

.1 Existing services and equipment shall be relocated or removed to suit new construction and renovation work.

.2 Services that are no longer required shall be removed or cut back and capped to the satisfaction of Consultant..

.3 Obtain written authorization from Consultant for renovation work that is not specifically indicated.

.4 Where modifications or connections to existing systems require shutdown of the system the Contractor shall submit a request for system shutdown describing the system or part to be

shutdown, the duration of the shutdown, the work planned and steps to be taken to reinstate the system to full operation. The request shall be submitted in the format stipulated by the Owner.

.5 All work required to prepare systems for shutdown and/or re-instatement, such as draining, chemical treatments, and re-filling shall be included in this Bid Price.

3.3 ABOVE GROUND PIPING INSTALLATION

.1 Cooperate with other trades whose work affects or is affected by work of this Section, to ensure satisfactory installation and to avoid delays. Provide all materials to be built-in such as sleeves, anchors, etc., together with accurate dimensions or templates, promptly.

.2 Layout all work accurately, installing piping parallel to lines of building.

.3 Install piping, wherever possible, in partitions and above ceiling. Do not install piping in outside walls unless so shown on drawings. Wrap un-insulated piping in masonry walls with building paper.

.4 Install concealed piping close to building structure to minimize furring dimensions.

.5 Provide adequate space around piping to facilitate application of insulation.

.6 Use dielectric couplings where piping of dissimilar metals connect.

.7 Where piping passes through concrete floors, or walls, sleeves shall be sized to permit the pipe to expand freely without binding or crushing pipe insulation.

.8 Where branch pipes are welded into main without the use of "T" connections, torch cut openings must be cut true, bevelled and filed smooth. Branch pipes must not be allowed to project inside of main pipe. Openings must not be cut large enough to permit entry of welding metal and slag within the pipe.

.9 Install automatic control valves and wells supplied under other Sections of this Division.

3.4 PIPING JOINTS

.1 Make joints in piping installed under this Division using persons familiar with the particular materials being used and in accordance with Canadian Plumbing Code, manufacturer's instructions, and as specified herein.

.2 Use 95/5 Sb.Sn (tin-antimony) solder for joining copper drainage tubing smaller than 4" (100mm), and for joining copper water tubing installed above grade, and smaller than 4" (100mm).

.3 Use silver solder or Silfos for joining copper water tubing installed below grade, and all copper tubing 4 " (100mm) and larger in size.

.4 Carefully ream joints in threaded pipe and paint with approved graphite type joint sealer on male connections only. Make connections with proper wrench to suit pipe size. Where leaks occur, the joint shall be disassembled and corrected if possible, or replaced. Over-tightening, caulking or peening will not be acceptable.

.5 Make joints in cast iron pipe with standard M-J joints in accordance with manufacturer's recommendations and CSA B70-M86.

.6 Install unions or welding flanges at connections to valves, etc. to facilitate removal.

3.5 FLUSHING AND CLEANING

.1 Flush and sterilize domestic water mains in accordance with procedures established by AWWA Specification C601.

.2 Flush new domestic water piping in accordance with Local and Provincial Codes.

.3 Thoroughly flush all other piping installed by this Division.

.4 Remove, clean and replace all strainers in systems after flushing.

.5 Thoroughly clean all equipment and fixtures, lubricate mechanical equipment, and leave all items in perfect order ready for operation.

3.6 PIPING SYSTEMS TESTING AND INSPECTION

.1 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

.2 Test all piping at the completion of roughing-in, before connecting to existing systems, and prior to concealment, insulation or covering of piping.

.3 Make tests, which are required by any authority having jurisdiction, in the presence of the authority's authorized inspector and shall be certified by them.

.4 Conduct tests in the presence of:

.1 Authorized inspector(s) for authorities having jurisdiction.

.2 The Owner's Representative

.3 The Consultant

.5 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.

.6 Repair all leaks exposed during testing and retest. If defects in pipe or fittings are discovered in the system, they shall be removed and replaced.

.7 Certify tests: not required by authorities having jurisdiction.

3.7 EQUIPMENT TESTING AND INSPECTION

.1 Test operation of equipment installed under this Division according to instructions in appropriate articles of this Division. Make any required adjustments or replacements to ensure equipment is operating as intended. Retest equipment requiring adjustment or replacement.

.2 Pay all fuel consumption charges for equipment under testing and during commissioning.

.3 Conduct tests before application of external insulation and before concealment of piping or ductwork.

.4 Arrange and pay for inspections by authorities as required by code and complete any changes or alterations required by such inspections.

.5 Conduct tests in the presence of:

.1 Authorized inspector(s) for authorities having jurisdiction.

.2 The Systems Verification Agency.

.3 The Consultant.

.4 The Owner's Representative.

.6 Notification must be given at least 48hours in advance of tests being conducted, to all persons required to be present.

3.8 TESTING AND BALANCING

.1 Allow sufficient time for testing and verification prior to substantial completion. Notify Testing and Balancing Agency on completion of adjusting and balancing of systems.

.2 Adjust systems and components (drives, sheaves, belts, etc.) as required by Testing and Balancing Agency.

.3 Maintain systems in full operation during testing and verification.

.4 Make adjustments to control systems as required to facilitate verification. Maintain all safety controls in operation.

.5 Check and correct alignment of V-belts, drive shaft coupling drives, etc. as required by Testing and Balancing Agency.

.6 Provide pitot tube test fittings at all main branches of sheet metal work and at intake and discharge locations of air handling systems as required by Testing and Balancing Agency.

3.9 ELECTRICAL COMPONENTS AND WIRING

.1 Conform to requirements of Division 26 for all wiring included in Divisions 21, 22 and 23. Includes pre-wired equipment provided by Sections under Divisions 21, 22 and 23.

.2 Ensure that all pre-wired electrical equipment is CSA approved. Arrange and pay for special approval where this is not possible.

.3 Coordinate all wiring requirements with other Divisions. Line voltage wiring from power distribution panels to starters and from starters to motors will be provided under Division 26. All the field wiring for equipment shall be included under Division 26, unless specifically called for.

3.10 PROTECTION

.1 Protect finished and unfinished work by tarpaulins, or other covering, from damage due to execution of work under this Division.

.2 Repair to satisfaction of Consultant, damage to building resulting from failure to provide such protection.

.3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.

.4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.

.5 Temporary filters shall be removed on completion of the construction works.

3.11 CUTTING AND PATCHING

.1 Include cutting and patching as required in execution of work under respective Sections of this Division.

.2 Holes through the structure will not be permitted without written approval of the Consultant. Any and all openings required through the completed structure must be clearly and accurately shown on a copy of the relevant structural drawing(s). Exact locations, elevations and size of the proposed opening must be identified well in advance of the need for the work.

.3 All sleeved or formed openings through the structure must be shown on sleeving drawings and must be approved by the Structural Consultant prior to construction.

.4 The Contractor shall conduct exploratory work including x-ray of the existing structure, shall mark the location of embedded reinforcements, anchors, conduits and piping on exposed surfaces of adjacent floors and/or walls and shall pay all associated costs.

.5 Reinforcing shall not be cut or modified without prior approval of the Structural Consultant. Should re-enforcement be cut without such prior approval, the cost of any additional re-enforcement deemed necessary by the Structural Consultant shall be the responsibility of this Contractor.

.6 Alternative imaging techniques are subject to the approval of the Structural Consultant.

.7 Ensure that cutting and patching of roofs and reinforced concrete structures is executed by specialists familiar with the materials affected, and is performed in a manner to neither damage nor endanger the work. Coordinate and supervise such cutting and patching.

.8 Maintain the integrity of fire rated assemblies where they are pierced by ducts and pipes.

.9 Make good surfaces affected by this work and repair finish to satisfaction of Consultant. Finish painting, where required, will be provided under Division 09.

.10 Stop work immediately upon discovery of any hazardous material and report discovery to the Owner and Consultant. Obtain instruction prior to proceeding with the work.

3.12 EXCAVATING AND BACKFILLING

.1 Be responsible for excavation and backfilling necessary for installation of underground work under this Division.

.2 Excavate to the depth and dimensions shown on drawings.

.1 Excavate to the depth and dimensions shown on drawings.

.2 Keep excavation free of water by bailing, pumping or a system of drainage as required.

.3 Cut and trim banks of excavation evenly, as nearly vertical as possible, and shore if required to prevent caving-in.

.4 Keep bottom of excavation clean and clear of loose material. Slope or grade as required.

.5 . Provide shoring in accordance with The Occupational Health and Safety Act, and Regulations for Construction Projects.

.6 Notify the Consultant immediately in case of encountering any unstable ground, unsuitable for bearing of pipes. Consultant will decide the method of installation of pipes in unstable ground.

.7 Inform the Consultant immediately if the excavation reveals seepage zones, springs or other unexpected sub-surface conditions which may necessitate revisions to drainage or water supply systems.

.3 Obtain Consultant's approval prior to commencement of backfilling of trenches. Backfill the trenches carefully to prevent injury to the work and subsequent settlement and execute backfilling generally as follows:

.1 provide minimum 6" (150mm) fine gravel or coarse sand bedding (Class B) or as indicated for the bottom of trenches.

.2 backfill above pipe bedding with granular material specified, hand tamp in layers of 6" (150mm) thickness. Extend backfill 12" (300mm) above pipe.

.3 backfill and consolidate remainder of trench depth below paved or gravelled areas with granular Class "B" aggregate in 6" (150mm) layers to an elevation to allow for thickness of Class "A" aggregate and asphalt pavement.

.4 backfill and consolidate reminder of trench depth below sodded or seeded areas with specified granular material or material obtained from site excavation where approved by Consultant, in 9" (225mm) layers to an elevation 6" (150mm) below of proposed grades in sodded/seeded areas.

.5 compact each layer thoroughly at optimum moisture content with approved hand or mechanical tampers to a density equal to;

.1 Behind foundation and retaining walls on grades

.2 Below sodded or seeded areas

.6 Do not puddle or flood with water for consolidating backfill. Add Water during the compaction to optimum moisture content of backfilling material.

3.13 SUPPORT AND ATTACHMENT

.1 Support and attach piping, ductwork fixtures and equipment from load bearing structures such as beams, joists, reinforced concrete slabs and concrete block walls, and do not support from or attach to steel roof deck and/or wall or ceiling finishes. Roof mounted mechanical equipment and services shall be anchored to the roof structure to resist both lateral and uplift wind forces in accordance with requirements of the Ontario Building Code.

3.14 PAINTING

.1 Repair minor damage to finish of equipment with standard factory applied baked enamel finish under the appropriate Sections of this division. Replace entirely, items suffering major damage to finish if too extensive to be repaired in the opinion of the Consultant.

.2 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.

3.15 DISSIMILAR METALS

.1 Separate dissimilar metals in order to prevent galvanic corrosion.

.2 Provide gaskets or shims of approved materials to avoid electrolytic action.

.3 Use dielectric unions and/or flanges where piping of dissimilar metals are connected.

3.16 EQUIPMENT BASES AND CURBS

.1 Supply and erect structural work required for installation of mechanical equipment.

.2 Build concrete bases 6" (150mm) high, providing all necessary inserts, anchor bolts and other fasteners required, for floor mounted tanks, heaters, pumps, air handlers, boilers, etc. Make concrete bases 2" (50mm) larger all around than the base of the supported equipment and trowel finish to a neat smooth finish. Anchor equipment to pads using 8" (200mm) cast-in-place anchor bolts. Ensure concrete supplied under this Division is 2500psi (17MPa) compressive strength after 28 days.

.3 Build 4" (100mm) high concrete curbs around all openings through floors for ductwork. Make allowances for installation of ductwork and fire dampers where required. Ensure joint between curb and floor is watertight and maintains integrity of floor membrane where applicable.

3.17 BELT DRIVES AND SHEAVES

.1 Provide belt driven equipment with V-belt drive, designed for at least 130% of motor nameplate horsepower rating and in accordance with manufacturer's recommendations for type of service intended. Ensure belt drives are at least 95% efficient. Balance and properly align drives. Provide matched sets of belts for multiple belt assemblies. Select belts to suit starting torque of driver. Do not use single belt drives only for motors larger than two horsepower.

.2 Provide motor sheaves for one and two belt drives of variable pitch type, with Dodge key adjustments. Supply two sets of fixed drive sheaves for drives with three or more belts. Install first set of fixed motor sheaves to obtain the originally specified rpm. After initial test and preliminary adjustment, supply and install the second set of fixed sheaves if necessary, to provide the design flow quantities as established on the job. Obtain correct total flow rate for fans through speed changes and not by throttling.

.3 Provide adjustable sheaves on motor sizes up to 2HP (1492w) and fixed sheaves on larger motors.

3.18 GUARDS

.1 Provide OSHA compliant guards for exposed drives as follows;

.1 expanded metal screen (both sides) welded to 1" (25mm) steel angle frame.

.2 18ga. 1" (25mm) thick galvanized sheet metal tops and bottoms.

.3 removable sides for servicing.

.4 1-1/2" (40mm) dia. holes on both shaft centres for insertion of tachometer.

.2 Provide means to permit lubrication and use of test instruments with guards in place.

.3 Install belt guards to permit movement of motors for adjusting belt tension.

.4 For flexible couplings, provide removable, "U" shaped, 12ga. 1/10" (2.7mm) thick galvanized frame and 18ga. 1/25" (1.2mm) thick expanded mesh face.

.5 Provide 3/4" (20mm) galvanized mesh wire screen on inlet or outlet of exposed fan blades such that net free area to openings is not less than 1.25 of original openings.

3.19 FIELD QUALITY CONTROL

.1 Temporary and Trial Usage

.1 Allow the Owner the privilege of temporary and trial usage of installed equipment, as soon as work is complete, for a period of time required to conduct a thorough test.

.2 Do not construe such usage as evidence of acceptance of work by Owner

.3 Repair damage to work tested, resulting from such trial usage, by this Contractor at no cost to Owner.

.2 Systems Verification:

.1 Verify the correct installation and proper operation of equipment and systems installed. Adjust and balance each system as necessary to achieve optimum operation of each system.

.2 Co-operate with the Systems Verification agency as follows:

.1 provide assistance when and as requested

.2 co-ordinate completion of work systematically to permit orderly verification and adherence to schedules,

.3 provide additional necessary flow balancing devices as directed by agency,

.4 notify Systems Verification Agency of tests being conducted.

3.20 ADJUST AND CLEAN

.1 Clean equipment and fixtures, lubricate mechanical equipment installed under this Division and leave items in perfect order ready for operation.

.2 Test and adjust control devices, instrumentation, relief valves, dampers, etc., installed in this Division after cleaning of systems and leave in perfect order ready for operation.

.3 Remove from the premises upon completion of work of this division, debris, surplus, and waste materials resulting from operations.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 REFERENCES

.1 ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

.1 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.

.2 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

.3 Product Data: Provide manufacturers catalogue literature for each product required.

.4 Manufacturer's Installation Instructions: Indicate special procedures, and installation.

2 Products

2.1 NAMEPLATES

.1 Fasten nameplates securely in a conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.

.2 Identify equipment type and number and service of areas or zone of building served.

.3 For each item of equipment which may be started automatically or remotely, add a red lamacoid plate, 2-1/2" x 9" (60 x 230 mm), reading: "WARNING. THIS EQUIPMENT IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME."

2.2 TAGS

.1 Metal Tags: Brass with stamped letters; tag size minimum 1-1/2" (40mm) diameter with smooth edges.

.2 Chart: Typewritten letter size list in anodized aluminum frame.

2.3 STENCILS

.1 Stencils: With clean cut symbols and letters of following size:

.1 3/4"-1-1/4" (20-30mm) Outside Diameter of Insulation or Pipe: 8" (200mm) long colour field, 1/2" (15mm) high letters.

.2 1-1/2"-2" (40-50mm) Outside Diameter of Insulation or Pipe: 8" (200mm) long colour field, 3/4" (20mm) high letters.

.3 2-1/2"-6" (65-150mm) Outside Diameter of Insulation or Pipe: 12" (300mm) long colour field, 1-1/4" (30 mm) high letters.

.4 8" - 10" (200-250mm) Outside Diameter of Insulation or Pipe: 24" (600mm) long colour field, 2-1/2" (65 mm) high letters.

.5 Over 10" (250 mm) Outside Diameter of Insulation or Pipe: 32" (800mm) long colour field, 3-1/2" (90mm) high letters.

.6 Ductwork and Equipment: 2-1/2" (65mm) high letters.

2.4 SELF ADHESIVE PIPE MARKERS

.1 Vinyl: Factory fabricated vinyl, 0.13 mm (5 mil) thick, preformed to fit around pipe or pipe covering.

.2 Polyester: Factory fabricated polyester, 0.05 mm (2 mil) thick, coated with acrylic adhesive.

.3 Plastic: Factory fabricated plastic film, roll formed, clear laminated to protect lettering.

3 Execution

3.1 PREPARATION

.1 Degrease and clean surfaces to receive adhesive for identification materials.

.2 Prepare surfaces for stencil painting.

3.2 INSTALLATION

.1 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer (VOC content not to exceed 680g/L).

.2 Install tags with corrosion resistant chain.

.3 Comply with standard detail drawing plate, "Detail of Piping Identification".

.4 Apply stencil markings on all covered piping.

.5 Install plastic tape pipe markers complete around bare pipe to manufacturer's instructions.

.6 Label piping that is heat traced or equipped with heating cable "HEAT TRACED" in addition to other identification. Locate such labels adjacent to other identifications.

.7 Install underground plastic pipe markers 6"-8" (150-200mm) below finished grade, directly above buried pipe.

.8 Identify air handling units, fans, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

.9 Identify control panels and major control components outside panels with plastic nameplates.

.10 Identify thermostats relating to terminal boxes or valves with nameplates.

.11 Identify valves in main and branch piping with tags. Consecutively number valves in each system.

.12 Tag automatic controls, instruments, and relays. Key to control schematic.

.13 Identify piping, concealed or exposed, with stencilled painting and plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 6m on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

.14 Identify covered ductwork with stencilled painting and bare ductwork with plastic tape duct markers. Identify ductwork with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

.15 For each item of equipment which may be started automatically or remotely, add a red lamacoid plate, 2-3/8" x 9" (60 x 230mm), reading: "WARNING. THIS EQUIPMENT IS AUTOMATICALLY CONTROLLED. IT MAY START AT ANY TIME."

3.3 SCHEDULES

.1 Consult the Owner and identify piping, ductwork and equipment as directed;

.1 conforming to the Owner's existing identification practices, or

.2 conforming to the following Pipe and Valve Identification Table:

	Valve	Primary	Secondary
Pipe Marker Legend	Tag Legend	Colour	Colour
Cold Water	CW	Green	None
Condensate Return	CR	Yellow	Black
Dom. Hot Water Supply	DHWS	Green	None
Dom. Hot Water Recirc.	DHWR	Green	None
Glycol Heating Supply	GHS	Yellow	Black
Glycol Heating Return	GHR	Yellow	Black
Hot Water Heating Supply	HWS	Yellow	Black
Hot Water Heating Return	HWR	Yellow	Black
Propane Gas	GAS	Yellow	Black
Refrigerant Liquid	REFL	Yellow	Black
Refrigerant Suction	REFS	Yellow	Black
Sanitary Sewer	SAN	Green	None
Vent		Green	None

.2 Where coloured PVC jacketing is specified, conform to the following schedule;

Service	Legend	Colour
Cold Water	CW	Dark Green
Dom. Hot Water Supply	DHWS	Yellow
Dom. Hot Water Recirc.	DHWR	Yellow
Hot Water Heating Supply	HWS	Yellow
Hot Water Heating Return	HWR	Yellow
Sanitary Sewer	SAN	Dark Grey
Steam	STM	Orange

.3 The above lists are to be used as a guideline for colour coding only, and is not intended to supersede lists of other authorities or agencies. (i.e. Ministry of Environment; Ministry of Government Services, Canadian Government Standards Board).

3.4 MANUFACTURE'S NAMEPLATE

.1 Provide metal nameplates on each piece of equipment, mechanically fastened with raised or recessed letters.

.2 Include registration plates, Underwriters' Laboratories and CSA approval, as required by respective agency and as specified. Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors, all factory supplied.

.3 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.5 FLOW DIAGRAMS AND DIRECTORIES

.1 Provide Consultant with six identification flow diagrams of approved size for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.

.2 Install where agreed with the Owner one copy of each flow diagram and valve schedule mounted in glazed frame. Provide one copy of each in Operation and Maintenance Manual.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Thermometers,

.2 Pressure Gauges.

.3 Water Meters.

.4 Sanitary Flow Meters.

1.3 REFERENCES

.1 ASME B40.100 - Pressure Gauges and Gauge Attachments.

.2 ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.

.3 ASTM E1 - Specification for ASTM Thermometers.

.4 ASTM E77 - Inspection and Verification of Thermometers.

.5 AWWA C700 - Cold Water Meters - Displacement Type, Bronze Main Case.

.6 AWWA C701 - Cold Water Meters - Turbine Type, for Customer Service.

.7 AWWA C702 - Cold Water Meters - Compound Type.

.8 AWWA C706 - Direct-Reading, Remote Registration System for Cold-Water Meters.

.9 AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

.10 ISA RP 3.2 - Flange Mounted Sharp Edged Orifice Plates for Flow Measurement.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 23 01 00, for the following items:

.1 Thermometers,

.2 pressure gauges,

.3 sanitary flow meters,

.4 water meters.

2 Products

2.1 THERMOMETERS

.1 Thermometers for use in pipelines, shall be Trerice model BX9-1-403 heavy duty industrial type with dual scale range (metric and imperial), adjustable angle separable sockets connections, cast aluminum case finished in dull black baked enamel, glass front with chrome plated frame, 225mm (9") long scale and red reading mercury. Range of scale, unless otherwise specified shall be from approximately 20% below minimum to 20% above maximum temperature encountered. Thermometers shall have extension necks and extended steams.

.2 Duct thermometers shall be Trerice model BX9-9-006 flange mounted on ducts, using sheet metal screws. They shall be similar to the piping thermometers specified above with the addition of a perforated bulb guard.

.3 Thermometers located over 2.7m (9') above floor shall be remote mounted dial type Trerice model L-80341 with 115mm (4-1/2") stainless steel case back flange, liquid filled, bottom outlet, connecting tubing, brass movement, bronze bearings, stainless steel pointer, glass window and white background and black markings and be mounted on a steel or aluminum plate at eye level. Remote bulb shall be brass for piping and coiled copper for ductwork.

.4 Acceptable Manufacturers, subject to shop drawing review: Ashcroft, U. S. Gauge, Weiss Instruments, Winter's Thermogauges Ltd.

.5 Thermometer scale ranges shall be as follows:

Combination Systems	Scale Range
Hot water heating (Low temperature, scheduled and constant temperature, Glycol heating	0C to 115C (30F to 240F)
Domestic hot water	0C to 82C (30F to 180F)
Ductwork, outdoor air	-40C to 50C (-40F to 120F)
Ductwork, supply and return air	0C to 82C (30F to 180F)

2.2 PRESSURE GAUGES

.1 Pressure gauges shall be Trerice model 600C with 115mm (4-1/2") diameter black finished cast aluminum case, brass socket, phosphor bronze bourdon tube, bronze movement glass window, and suitably sized model 872 snubber. Bourdon tube shall be silver brazed at socket and at linkage. Dial shall be white finish with black figures and graduations, mounted on movement assembly independent of gauge casing. Scales shall be combined (metric/Imperial). Operating pressure indication shall fall in middle 1/3 of scale range, if scale range is not otherwise indicated. Install a Schedule 80 seamless steel siphon in line to gauges on steam service. Gauges shall be 115mm (4-1/2") diameter unless specified otherwise.

.2 Acceptable Manufacturers, subject to shop drawing review: Ashcroft, U. S. Gauge, Weiss Instruments, Winter's Thermogauges Ltd.

2.3 WATER METERS

.1 Water meter shall be in accordance with the local authorities or shall be a Neptune Trident T-10 size as noted on drawing with roll-sealed direct and remote reading dial gauge and register, cast bronze main case, notating disc measuring chamber.

.2 Remote readout head shall be Neptune Pulser-RM with attached length of AWG # 20 pulse wire.

.3 Readouts shall be suitable for dual measure (Metric/Imperial) readout.

2.4 SANITARY FLOW METER

.1

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

.3 Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide syphon on gauges in steam systems. Extend nipples and syphons to allow clearance from insulation.

.4 Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-3/8" (60mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

.5 Install thermometers in air duct systems on flanges.

.6 Install thermometer sockets adjacent to control systems thermostat, transmitter, or sensor sockets. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

.7 Locate duct mounted thermometers minimum 10 feet (3m) downstream of mixing dampers, coils, or other devices causing air turbulence.

.8 Coil and conceal excess capillary on remote element instruments.

.9 Provide instruments with scale ranges selected according to service with largest appropriate scale.

.10 Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

.11 Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

.12 Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Standard access doors.

1.3 SUBMITTALS

.1 Product Data: manufacturers catalogue brochure identifying product features.

.2 Shop drawings indicating materials, finishes, dimensions and methods of attachment.

2 Products

2.1 MANUFACTURES

.1 Manufacturer: Acudoor.

.2 Other acceptable manufacturers offering equivalent products, subject to shop drawing review.

.1 LeHage

.2 CEB

.3 Contour Model

2.2 STANDARD

.1 Minimum 12ga.

.2 Steel epoxy coated access doors for ceiling installations

.3 304 stainless steel with satin finish for wall installations

.4 heavy duty fully concealed hinges

.5 positive locking device.

.6 Access doors as recommended by manufacturer for particular installation.

3 Execution

3.1 INSTALLATION

.1 Supply access doors for access to equipment requiring service, lubrication or adjustment and all concealed valves, cleanouts, trap primers, control and volume dampers, and other such equipment.

.2 Turn over access doors to the appropriate general trade for installation under other sections.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENT

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES:

.1 Sealants

.2 Fire stopping sealants

.3 Sleeves

.4 Flashings and counter-flashings

.5 Escutcheons and plates

1.3 SUBMITTALS

.1 Product Data: physical properties, application limits.

.2 Manufacturer's Installation Instructions.

.3 Submit manufacturer's performance data, certification agency file numbers and catalogue information.

.4 Prepare and submit a schedule of service penetration systems to be employed indicating the ULC listing designation, services involved, location of opening through fire separation and the components of the fire separation and/or assembly.

1.4 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture of sealants with minimum three years documented product development, testing, and manufacturing experience.

.2 Fire stop components and assemblies shall be ULC listed and tested in accordance with ULC S115 Standard Method of Fire Test for Fire stop Systems.

1.5 REGULATORY REQUIREMENTS

.1 Conform to Ontario and national Building Code.

.2 Conform to Ontario and National Fire Code.

2 PRODUCTS

2.1 ADHESIVES, SEALANTS, PAINTS AND COATINGS

.1 Adhesives, Sealants, Paints and Coatings: Use only low VOC emitting materials meeting following criteria;

.1 Sealants for Service Penetrations: maximum VOC emission of 650g/L clear and 350g/L pigmented.

.2 Sealants for fire stopping: max. VOC emission of 650g/L clear and 350g/L pigmented.

2.2 FIRE STOPPING COMPOUNDS

.1 Manufacturer: 3M products indicated.

.2 Other acceptable manufacturers offering equivalent products.

.1 Dow Corning

.2 John Manville

.3 Hilti Firestop Systems

.3 Fire Rated Sealants: intumescent material, synthetic elastomers, capable of expanding up to 8 to 10 times when exposed to temperatures of 250F (121C) or higher. ULC listed and labelled.

2.3 SEALANTS AND CAULKING

.1 Refer to Division 07.

2.4 SLEEVES

.1 Materials: minimum schedule 20 galvanized steel or cast iron.

2.5 ESCUTCHEONS

.1 Finish; Polished chrome

2.6 FLASHINGS AND COUNTER FLASHINGS

.1 Thaler or equivalent mechanical/electrical flashings as recommended for specific purpose.

.2 Stainless steel flashing sleeve, integral deck flange and EPDM seal.

2.7 PENETRATION SEALS

.1 Manufacturer: Link-Seal

.2 Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut.

3 EXECUTION

3.1 SEALANTS AND CAULKING

.1 Fill voids around pipes:

.1 Seal between sleeve and pipe in foundation walls and below grade floors with penetration seals (link-seal)). Install as per manufacturer's installation instructions.

.2 Where sleeves pass through non-fire rated walls or floors, caulk space between pipe and sleeve with fibreglass. Seal space at each end with waterproof, fire retardant, non-hardening mastic.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with easily removable filler.

.5 Coat exposed exterior surfaces or ferrous sleeves with heavy application of zinc rich paint (VOC content not to exceed 250 g/L).

.2 Temporarily plug all openings during construction.

3.2 FIRE STOPPING

.1 All openings in fire separations and fire rated assemblies for service penetrations shall be protected with ULC listed service penetration fire stop systems (SP).

.2 The service penetration fire stop system shall have F and FT ratings equal to or greater than ratings specified by the Architect for the fire separation (F) and firewall (FT) joint fire stop systems (JF).

.3 All components employed in the service penetration fire stop system shall conform to the ULC listing.

.4 Contractor shall prepare and submit a schedule of service penetration fire stop systems to be employed indicating the ULC listing designation, services involved, location of opening through fire separation and the components of the fire separation assembly.

.5 Refer to architectural drawings for ratings of fire separations and assemblies.

3.3 SLEEVES AND CURBS

.1 Provide pipe sleeves at points where insulated and un-insulated pipes pass through masonry or concrete.

.2 Provide sleeves of minimum schedule 20 galvanized steel or cast iron.

.3 Use cast iron or steel pipe sleeves with annular fin continuously welded at midpoint:

.1 through foundation walls, with penetration seals.

.2 through floors of mechanical rooms and equipment rooms.

.4 Provide 1/4" (6mm) clearance all around, between sleeve and pipes or between sleeve and insulation.

.5 Where piping passes below footings, provide minimum clearance of 2" (50mm) between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing with concrete of same strength as footing.

.6 Terminate sleeves flush with surface of concrete and masonry and 2" (50mm) above floors. Not applicable to concrete floors on grade.

.7 Provide watertight concrete curb 4" (100mm) high around mechanical services (pipes, ducts, conduits) which rise through mechanical (service) room floors. Provide minimum 4" (100mm) clearance between openings for services within curbs.

.8 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction, caulk between sleeve recess and pipe, fasten roof flashing to clamp device, make water-tight durable joint. Co-ordinate with roofing Section.

3.4 FLASHINGS

.1 Provide all flashing at each point where piping passes through the roof.

.2 Coordinate this work with the roofing Trades to ensure a satisfactory installation and to avoid delays.

3.5 ESCUTCHEON PLATES

.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

.2 Use chrome or nickel plated brass, solid type with set screws for ceiling or wall mounting.

.3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.

.4 Where sleeve extends above finished floor, escutcheon or plates shall clear sleeve extension.

.5 Secure to pipe or finished surface, but not insulation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Pipe and equipment hangers and supports

.2 Equipment bases and supports.

.3 Sleeves and seals.

.4 Flashing and sealing equipment and pipe stacks.

1.3 REFERENCES

.1 ASME B31.1-[07], Power Piping.

.2 ASME B31.2 - Fuel Gas Piping.

.3 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.

.4 ASME B31.9 - Building Services Piping.

.5 ASTM A 125, Standard Specification for Steel Springs, Helical, Heat-Treated.

.6 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.7 ASTM F708 - Design and Installation of Rigid Pipe Hangers.

.8 ASTM A 563, Standard Specification for Carbon and Alloy Steel Nuts.

.9 MSS SP 58, Pipe Hangers and Supports - Materials, Design and Manufacture

.10 MSS SP 69, Pipe Hangers and Supports - Selection and Application

.11 MSS SP 89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.12 UL 203 - Pipe Hanger Equipment for Fire protection Service.

2 Products

2.1 PIPE HANGERS AND SUPPORTS

.1 Manufacturers:

.1 Anvil

.2 Myatt

.3 Hunt

.2 Hydronic Piping:

.1 Conform to CSA B-51 and ASME B31.9.

.2 Hangers for Pipe Sizes 1/2" to 1-1/2" (13 to 38mm): Carbon steel, adjustable swivel, split ring.

.3 Hangers for Hot Pipe Sizes 2" to 4" (50 to 100mm): Carbon steel, adjustable, clevis.

.4 Hangers for Hot Pipe Sizes 6" (150mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.

.5 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

.6 Multiple or Trapeze Hangers for Hot Pipe Sizes 6" (150mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

.7 Wall Support for Pipe Sizes to 3" (75mm): Cast iron hook.

.8 Wall Support for Pipe Sizes 4" (100mm) and Over: Welded steel bracket and wrought steel clamp.

.9 Wall Support for Hot Pipe Sizes 6" (150mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

.10 Vertical Support: Steel riser clamp.

.11 Floor Support for Hot Pipe Sizes to 4" (100mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

.12 Floor Support for Hot Pipe Sizes 6" (150mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support

.13 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

.3 Plumbing Piping - Drain, Waste, and Vent:

.1 Conform to ASME B31.9.

.2 Hangers for Pipe Sizes 1/2" to 1-1/2" (15 to 38mm): Malleable iron, adjustable swivel, split ring.

.3 Hangers for Pipe Sizes 2" (50mm) and Over: Carbon steel, adjustable, clevis.

.4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

.5 Wall Support for Pipe Sizes to 3-1/4" (80mm): Cast iron hook.

.6 Wall Support for Pipe Sizes 4" (100mm) and Over: Welded steel bracket and wrought steel clamp.

.7 Vertical Support: Steel riser clamp.

.8 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

.9 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

.4 Plumbing Piping - Water:

.1 Conform to ASME B31.9.

.2 Hangers for Pipe Sizes 1/2" to 1-1/2" (15 to 38mm): Malleable iron, adjustable swivel, split ring.

.3 Hangers for Cold Pipe Sizes 2" (50mm) and Over: Carbon steel, adjustable, clevis.

.4 Hangers for Hot Pipe Sizes 2" to 4" (50 to 100mm): Carbon steel, adjustable, clevis.

.5 Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

.6 Wall Support for Pipe Sizes to 3-1/4" (80mm): Cast iron hook.

.7 Wall Support for Pipe Sizes 4" (100mm) and Over: Welded steel bracket and wrought steel clamp.

.8 Vertical Support: Steel riser clamp.

.9 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

.10 Floor Support for Hot Pipe Sizes to 4" (100mm): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

.11 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.2 ACCESSORIES

.1 Hanger Rods: galvanized, carbon steel continuous threaded.

.2 Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

3 Execution

3.1 INSTALLATION

.1 Install hangers, supplies and attachments as required to properly support from the building structure and to manufacturer's instructions and best trade practises.

3.2 INSERTS

.1 Provide inserts for placement in concrete formwork.

.2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

.3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4" (100mm).

.4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

.5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.3 PIPE HANGERS AND SUPPORTS

.1 Support horizontal piping as scheduled.

.2 Install hangers to provide minimum 1/2" (13mm) space between finished covering and adjacent work.

.3 Place hangers within 12" (300mm) of each horizontal elbow.

.4 Use hangers with 1-1/2" (38mm) minimum vertical adjustment.

.5 Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5m) maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical cast iron pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Support riser piping independently of connected horizontal piping.

.9 Provide copper plated hangers and supports for copper piping.

.10 Design hangers for pipe movement without disengagement of supported pipe.

.11 Prime coat exposed steel hangers and supports. Refer to Section 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 EQUIPMENT BASES AND SUPPORTS

.1 Provide housekeeping pads of concrete, minimum 4" (100mm) thick and extending 6" (150mm) beyond supported equipment. Refer to Section 030.

.2 Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

.3 Construct supports of steel members. Steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.4 Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

.1 Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

.2 Flash vent and soil pipes projecting 3" (75mm) minimum above finished roof surface with lead worked 1" (25mm) minimum into hub, 8" (200mm) minimum clear on sides with 24" x 24" (600 x 600mm) sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash, and seal.

.3 Flash floor drains in floors with topping over finished areas with lead, 10" (250mm) clear on sides with minimum 36" x 36" (900 x 900mm) sheet size. Fasten flashing to drain clamp device.

.4 Seal roof, floor, shower and mop sink drains watertight to adjacent materials.

.5 Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed to manufacturer's instructions for sound control.

3.6 SLEEVES

.1 Set sleeves in position in formwork. Provide reinforcing around sleeves.

.2 Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

.3 Extend sleeves through floors 1" (25mm) above finished floor level. Caulk sleeves.

.4 Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk. air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

.5 Install chrome plated steel escutcheons at finished surfaces.

3.7 SCHEDULES

.1 For Steel or Iron Pipes

Pipe Diameter mm (ins)	Horizontal Spacing of Supports mm (ins)	Threaded Rod Diameter mm (ins)
13 (1/2)	1500 (60)	10 (3/8)
19 (3/4)	1800 (72)	10 (3/8)
25 (1)	2100 (84)	10 (3/8)
32 (1-1/4)	2400 (96)	10 (3/8)
38 (1-1/2)	2400 (96)	10 (3/8)
50 (2)	2400 (96)	10 (3/8)
65 (2-1/2)	2400 (96)	13 (1/2)
75 (3)	2400 (96)	13 (1/2)
100 (4)	2400 (96)	16 (5/8)
150 (6)	3600 (144)	19 (3/4)
200 (8)	3600 (144)	22 (7/8)

.2 For Copper Tubing, Annealed Steel Tubing or PVC Piping

Pipe Diameter mm (ins)	Horizontal Spacing of Supports mm (ins)	Threaded Rod Diameter mm (ins)
13 (1/2)	1500 (60)	10 (3/8)
19 (3/4)	1500 (60)	10 (3/8)
25 (1)	1800 (72)	10 (3/8)
32 (1-1/4)	2100 (84)	10 (3/8)

38 (1-1/2)	2400 (96)	10 (3/8)
50 (2)	2400 (96)	10 (3/8)
65 (2-1/2)	3000 (120)	13 (1/2)
75 (3)	3000 (120)	13 (1/2)
100 (4)	3000 (120)	16 (5/8)

.3 For Cast Iron (MJ) Pipes

Pipe Diameter mm (ins)	**Horizontal Spacing of Supports mm (ins)**	**Threaded Rod Diameter mm (ins)**
< 75 (3)	1000 (40)	16 (5/8)
>100 (4)	1000 (40)	19 (3/4)

.4 For PVC or ABS Pipes

Pipe Diameter mm (ins)	**Horizontal Spacing of Supports mm (ins)**	**Threaded Rod Diameter mm (ins)**
< 75 (3)	1200 (48)	10 (3/8)
>100 (4)	1200 (48)	13 (1/2)

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Flexible pipe connectors

.2 Expansion joints and compensators

.3 Pipe loops, offsets, and swing joints

.4 Anchors and guides.

1.3 REFERENCES

.1 CSA B51 Boiler, Pressure Vessel and Pressure Piping Code

.2 ASME B31.1 Code for Power Piping

.3 ASME B31.3 Process piping

.4 MIL-E-17814E - Expansion Joints, Pipe, Slip-Type, Packed

1.4 SUBMITTALS

.1 Product Data:

.1 Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per metre and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

.2 Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

.2 Design Data: Submit shop drawings for expansion compensation, signed and sealed by a professional engineer licensed in Ontario. Provide selection criteria used.

.3 Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

.2 Design expansion compensating system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the Province of Ontario.

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

.2 Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.7 WARRANTY

.1 Warranty: 5-year replacement warranty.

1.8 EXTRA MATERIALS

.1 Provide two 340gm containers of packing lubricant and cartridge style grease gun.

1.9 PERFORMANCE REQUIREMENTS

.1 Provide structural work and equipment required to control expansion and contraction of piping.

.2 Verify that anchors, guides, and expansion joints provided, adequately protect system.

.3 Arrange all piping so that expansion and contraction of any piping may take place without placing undue strain on the piping or connections to the equipment. Use swing joints and suitable expansion joints wherever necessary due to field conditions and where indicated on the drawings.

.4 This Section shall analyze each section of pipe installed between constraints and shall determine the potential for expansion of the pipe based on pipe temperature at installation and pipe temperatures throughout the pipe's operating range. Where potential expansion exceeds 1" (25mm) over the length of the pipe section, expansion compensators shall be installed. Pipe sections are constrained where they penetrate walls, partitions, floors, ceilings, roofs and movement of the pipe is restricted and where the pipe is anchored to the building structure.

.5 Expansion Calculations:

.1 Safety Factory: 30 percent.

.2 Installation Temperature: 50F (10C).

.3 Hot Water Heating: 210F (99C).

.4 Domestic Hot Water: 140F (60C).

2 PRODUCTS

2.1 MANUFACTURERS

.1 Manufacturers must be certified by the Expansion Joint Manufacturers Association (EJMA)

.2 Flexible Pipe Connectors

.1 Flex-Pression Ltd.

.2 Sr. Flexonics

.3 Ontario Hose

.4 Colton Industries

.3 Expansion Joints

.1 Flex-Pression Ltd.

.2 Hyspan Precision Products, Inc.

.3 Sr. Flexonics

.4 Pipe Alignment Guides

.1 Flex-Pression Ltd.

.2 Hyspan Precision Products, Inc.

.3 Sr. Flexonics

.5 Alternates are subject to shop drawing review.

2.2 PIPE ALIGNMENT GUIDES

.1 Steel Pipe:

.1 Radial "spider" type, minimizing piping motions in non-axial planes.

.2 Constructed of carbon steel with a 360-degree two-piece bolted housing, and 360-degree two-piece bolted clamps with spider type legs.

.3 Provide an insulation clearance of 1.5" on sizes 6" IPS and under, and 2.0" on sizes 8" IPS and over.

.4 Axial travel shall be 3" for sizes 2" IPS and under, and 6" for sizes 2-1/2" IPS and over.

.5 Refer to piping and expansion joint schedules for specific insulation and motion requirements.

.6 Basis of design: Hyspan Series 9500.

.2 Copper Pipe:

.1 Radial "spider" type, minimizing piping motions in non-axial planes.

.2 Constructed of carbon steel with non-metallic coating on the tube clamps, and a 360-degree two-piece bolted housing, and 360-degree two-piece bolted clamps with spider type legs.

.3 Provide an insulation clearance of 1.5".

.4 Axial travel shall be 3" for sizes 2-1/2" and under, or 6" for sizes 3" and 4".

.5 Refer to piping and expansion joint schedules for specific insulation and motion requirements.

.6 Basis of design: Hyspan Series 9500.

2.3 FLEXIBLE PIPE CONNECTORS

.1 Copper Piping:

.1 Inner Hose: Bronze

.2 Exterior Sleeve: Braided bronze.

.3 Pressure Rating: 125psi (862kPa) WSP and 450F (232C).

.4 Joint: As specified for pipe joints.

.5 Size: Use pipe sized units

.6 Maximum offset: 3/4" (19mm) on each side of installed centre line.

.2 Steel Piping, 2" (50mm) diameter and smaller:

.1 Inner Hose: braided bronze.

.2 Exterior Sleeve: None.

.3 Pressure Rating: 125psi (862kPa) WSP and 450F (232C).

.4 Joint: Threaded.

.5 Size: Use pipe sized units.

.6 Maximum offset: 3/4" (19mm) on each side of installed centre line.

.3 Steel Piping, 2-1/2" to 3-1/2" (65mm to 90mm) diameter :

.1 Inner Hose: braided bronze.

.2 Exterior Sleeve: None.

.3 .Pressure Rating: 125psi (862kPa) WSP and 450F (232C).

.4 Joint: Flanged.

.5 Size: Use pipe sized units.

.6 Maximum offset: 3/4" (19mm) on each side of installed centre line.

2.4 EXPANSION JOINTS – COPPER PIPING

.1 Bronze Bellows Type:

.1 Construction: 2-ply bronze with anti-torque device, limit stops, internal guides.

.2 Pressure Rating: 125psi (862kPa) WSP and 400F (204C).

.3 Maximum Compression: 1-3/4" (45mm).

.4 Maximum Extension: 1/4" (6mm).

.5 Joint: Soldered.

.6 Size: Use pipe line sized units.

3 EXECUTION

3.1 INSTALLATION

.1 Install flexible pipe connectors and expansion joints as indicated on the drawings, as required to suit as-built pipe layout and to manufacturer's instructions.

.2 Ratings and bolt patterns for flanges shall suit design pressure and design temperature of piping system and match those of installed components.

.3 Construct spool pieces to exact size of flexible connection for future insertion.

.4 Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

.5 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

.6 Pipe anchors shall be installed securing the piping system to the building structure in order to control the direction and the amount of pipe movement. In addition, pipe anchors shall be installed to prevent separation of pipe due to hydraulic pressures. Pipe anchors shall be designed by the Contractor to accommodate all forces experienced. Prepare calculations for each anchor and submit to Consultant for review and approval. Provide pipe guides so movement is directed along axis of pipe only. Not less than two guides shall be provided on each side of an expansion joint. Erect piping such that strain and weight is not on cast connections or apparatus.

.7 Provide support and equipment required to control expansion and contraction of piping. Provide pipe offsets, and swing joints, or expansion joints where required. The Contractor may elect to install expansion loops in place of expansion compensators where there is adequate space to do so; subject to the approval of the Consultant. The Contractor shall prepare and submit detailed design calculations for each expansion loop proposed to the Consultant for review and approval prior to installation.

3.2 MANUFACTURER'S FIELD SERVICES

.1 Provide inspection services by manufacturer's representative for final installing and certify installation is to manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 CRITERIA

.1 Equipment shall be adequately isolated to maintain acceptable NC noise levels in occupied areas of the building as outlined in the following schedule. Approved, qualified personnel shall take noise measurements over complete audible frequency range in occupied zones adjacent to mechanical equipment rooms and main duct shafts and in other locations to ensure NC levels are achieved.

.2 Acceptable NC noise levels are as follows:

Public Areas	38 to 40

2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Vibration and noise control equipment shall be as manufactured by:

.1 Vibro-Acoustics Ltd.

.2 Amber/Booth Company

.3 Vibron Limited

.4 Korfund Sampson Ltd.

.5 Mason

2.2 SPRINGS

.1 Springs shall be stable, colour coded and selected to operate at no greater than 2/3 solid deflection.

.2 Springs for outdoor or high humidity applications shall have two coats of neoprene.

.3 Outside spring diameter shall be a minimum of 0.8 times rated vertical operating height and the ratio of horizontal stiffness to vertical stiffness (kx/ky) shall be greater than 1.2 times ratio of static deflection to operating height.

2.3 SPRING HANGERS

.1 Type SH shall be welded steel housing with one coat anti-rust paint, complete with colour coded stable spring, retaining cups and acoustic washer.

.2 Type SHR shall be as Type SH but shall have 25mm (1") elastomeric element in place of acoustic washer

3 Execution

3.1 INSTALLATION

.1 Equipment not specifically named in the application of isolation shall be isolated with deflection required to meet noise criteria.

.2 Isolate motor driven mechanical equipment (except in-line circulators).

.3 Support equipment such as fans, located in mechanical equipment rooms, and including any mezzanine levels, on spring vibration isolators, located as required so that piping systems and equipment connected to same shall be completely isolated from the building structure.

.4 Locate isolation for equipment as necessary to provide a stable support under saddles, frames and projections of equipment.

.5 Resiliently support piping 63mm (2 1/2") size and larger located within equipment rooms, with combination spring hangers or spring mounts. Nearest point of support to any piece of isolated equipment shall have an operating static defection of twice equipment isolator deflection but not more than 50mm (2"). Next two supports shall have a static deflection, equal to isolator deflection but not more than 50mm (2"). Other spring hangers and spring mounts shall have a minimum static deflection of 25mm (1"). Provide spring hangers at first two support locations of all piping either side of building expansion joints.

.6 All piping from heating pumps shall be supported with minimum 25mm static deflection spring mounts or hangers as follows:

Pipes up to 100mm (4") diameter	First 3 points of support

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Piping insulation

.2 Jackets

.3 Accessories

1.3 REFERENCES

.1 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

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

.3 ASTM C195 - Mineral Fibre Thermal Insulating Cement.

.4 ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

.5 ASTM C449/C449M - Mineral Fibre Hydraulic-setting Thermal Insulating and Finishing Cement.

.6 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.

.7 ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.

.8 ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

.9 ASTM C547 - Mineral Fibre Pipe Insulation.

.10 ASTM C552 - Cellular Glass Thermal Insulation.

.11 ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.

.12 ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

.13 ASTM C591 - Unfaced Preformed Cellular Polyisocyanurate Thermal Insulation.

.14 ASTM C610 - Moulded Expanded Perlite Block and Pipe Thermal Insulation.

.15 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

.16 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

.17 ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).

.18 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

.19 ASTM E84 - Surface Burning Characteristics of Building Materials.

.20 ASTM E96 - Water Vapour Transmission of Materials.

.21 NFPA 255 - Surface Burning Characteristics of Building Materials.

.22 UL 723 - Surface Burning Characteristics of Building Materials.

1.4 QUALITY ASSURANCE

.1 Materials: Flame spread/smoke developed rating of 25/50 or less to ULC S102 and ASTM E84.

1.5 QUALIFICATIONS

.1 Applicator: Company specializing in performing the work of this section with minimum three (3) years experience.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Transport, handle, store, and protect products.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

.3 Store insulation in original wrapping and protect from weather and construction traffic.

.4 Protect insulation against dirt, water, chemical, and mechanical damage.

1.7 SUBMITTALS

.1 Product Data: Provide product description, list of materials and thickness for each service, and locations

.2 Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

.2 Maintain temperature during and after installation for minimum period of 24 hours.

2 Products

2.1 GLASS FIBRE

.1 Manufacturers: Owens Corning Fiberglass

.2 Other acceptable manufacturers offering equivalent products:

.1 Manson

.2 Knauf Fiber Glass

.3 Schuller

.3 Insulation: ASTM C547; rigid moulded, non-combustible.

.1 'ksi' value : ASTM C335, 0.035 at 75F (24C).

.2 Minimum Service Temperature: -20F (-28.9C).

.3 Maximum Service Temperature: 302F (150C).

.4 Maximum Moisture Absorption: 0.2% by volume.

.4 Vapour Barrier Jacket

.1 ASTM C921, White kraft paper reinforced with glass fibre yarn and bonded to aluminized film.

.2 Moisture Vapour Transmission: ASTM E96; 0.02perm.

.3 Secure with self sealing longitudinal laps and butt strips.

.4 Secure with outward clinch expanding staples and vapour barrier mastic.

.5 Tie Wire: 1.3mm stainless steel with twisted ends on maximum 12" (300mm) centres. .5 Vapour Barrier Lap Adhesive: Compatible with insulation.

.6 Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool, VOC content not to exceed 80g/L.

.7 Fibrous Glass Fabric

.1 Cloth: Untreated; 9oz/sq yd (305g/sq m) weight.

.2 Blanket: 1.0lb/cu ft (16kg/cu m) density.

.8 Indoor Vapour Barrier Finish: Vinyl emulsion type acrylic, compatible with insulation, white colour, VOC content not to exceed 250g/L.

.9 Outdoor Vapour Barrier Mastic: Vinyl emulsion type acrylic, compatible with insulation, white colour.

.10 Insulating Cement: ASTM C449, VOC content not to exceed 80g/L.

2.2 UNDERGROUND INSULATION

.1 Manufacturer: Pittsburgh Corning Corporation

.2 Insulation: FOAMGLAS® insulation, ASTM C1639 "Standard Specification for Fabrication of Cellular Glass Pipe and Tubing Insulation".

.1 'k' Value: 0.039 at 24C.

.2 Maximum Service Temperature: 482C.

.3 Maximum Water Vapour Transmission: 0.1perm.

.4 Maximum Moisture Absorption: ASTM C240, 0.2% by volume.

.5 Density: 128kg/cu m.

.3 Jacketing: PITTWRAP® jacketing (FI-209).

.4 Asphalt Coating: PITTCOTE®300 Finish (FI-120).

.5 Reinforcing Fabric: PC® Fabric 79 (FI-159).

.6 Strapping Tape: glass fibre reinforced, 1" (25mm) Scotch brand #880 by 3M.

.7 Bore Coating: Hydrocal® B-11 by US Gypsum.

.8 High Temperature Sealant: PC® HI-TEMP/RTV Silicone Adhesive (FI-232) max. temperature limit of 500F (260C) continuous service.

2.3 JACKETS

.1 PVC Plastic

.1 Jacket: ASTM C921, One piece moulded type fitting covers and sheet material.

.1 Minimum Service Temperature: -31F (-35C).

.2 Maximum Service Temperature: 151F (66C).

.3 Moisture Vapour Transmission: ASTM E96; 0.03perm inches.

.4 Maximum Flame Spread: ASTM E84; 25 or less.

.5 Maximum Smoke Developed: ASTM E84; 50 or less.

.6 Thickness: 20mil (0.4mm) minimum.

.2 Colour: standard off-white OR coloured to suit pipe identification.

.3 Covering Adhesive Mastic: Compatible with insulation, maximum VOC content of 50g/L.

.4 Manufacturer;

.1 Ceel-Co 300 series

.2 Speedline Smoke Safe

2.4 ACCESSORIES

.1 Adhesives and finishes shall be as recommended by the insulation manufacturer and shall comply with Section 23 10 00. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings specified.

.2 Vapour retarder lap adhesive shall be water based, fire retardant.

.3 Tapes shall be of cloth reinforced aluminum, soft adhesive with minimum 2" (50mm) width.

.4 Tie wire shall be of 1/16" (1.5mm) ø stainless steel.

.5 Fasteners shall be of 1/8" (4mm) Ø pins, with 35mm square clips. Clip length to suit insulation thickness.

.6 Bands shall be 1/2" (12mm) wide 1/4" (6mm) thick galvanized steel.

.7 Facing shall be of 1" (25mm) galvanized steel hexagonal wire mesh attached on both faces of insulation.

3 Execution

3.1 EXAMINATION

.1 Verify that piping has been tested before applying insulation materials.

.2 Apply insulation after the required tests have been completed and approved by the Consultant.

.3 Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

.1 Install piping insulations to TIAC National Installation Standards.

.2 Apply insulation materials, accessories, jackets and finishes in accordance with manufacturer's written instructions and as specified.

.3 On exposed piping, locate insulation and cover seams in least visible locations.

.4 Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:

.1 Provide vapour barrier jackets, factory applied or field applied.

.2 Insulate fittings, joints, and valves with moulded insulation of like material and thickness as adjacent pipe.

.3 Finish with glass cloth and vapour barrier adhesive.

.4 PVC fitting covers may be used.

.5 Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.

.6 Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

.5 For insulated pipes conveying fluids above ambient temperature:

.1 Provide standard jackets, with or without vapour barrier, factory applied or field applied.

.2 Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.

.3 Finish with glass cloth and adhesive.

.4 PVC fitting covers may be used.

.5 For hot piping conveying fluids 140F (60C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

.6 For hot piping conveying fluids over 140F (60C), insulate flanges and unions at equipment.

.6 Inserts and Shields:

.1 Application: Piping 1-1/2" (40mm) diameter or larger.

.2 Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

.3 Insert Location: Between support shield and piping and under the finish jacket.

.4 Insert Configuration: Minimum 6" (150mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

.5 Insert Material: hydrous calcium silicate insulation.

.7 Finish insulation at supports, protrusions, and interruptions.

.8 For pipe exposed in mechanical equipment rooms or in finished spaces below 10 ft (3m) above finished floor, finish with canvas jacket sized for finish painting.

.9 For exterior applications, provide vapour barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

.10 For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with 1.0mil (0.025mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.3 TOLERANCE

.1 Substituted insulation materials: Thermal resistance within 10% at normal conditions, as materials indicated.

3.4 PIPE INSULATION

.1 Insulate piping with rigid pipe insulation as follows:

Service	**Operating Temperature Range F (C)**	**Pipe Diameter ins. (mm)**	**Insulation Thickness ins. (mm)**
Condensate (cold)	0 to 850 (-18 to 454)	All sizes	1/2 (13)
Domestic Cold Water	0 to 850 (-18 to 454)	All sizes	1 (25)
Domestic Hot Water and Recirculation	>105 (41)	< 2 (50)	1 (25)
		> 2-1/2 (65)	1-1/2 (38)
Hydronic Heating Supply and Return	105 to 140 (41 to 60)	< 4 (100)	1 (25)
		> 5 (125)	1-1/2 (38)
	141 to 200 (61 to 93)	All sizes	1-1/2 (38)
Sanitary Drainage (horizontal only)	40 to 55 (4 to 13)	All sizes	1 (25)

.2 Insulate fittings and flanges and pipe connections with insulated fitting covers.

.3 Wrap butt joints with a 4" (100mm) strip of fire resistant vapour barrier jacket cemented with lagging adhesive.

.4 Where the pipe hanger is around the insulation, provide an insulation protection shield within the pipe saddle. Coordinate with installation of hangers.

.5 Insulate all fittings, flanges and valves on pipes to provide equivalent insulation to that on adjoining pipe.

.6 Continue insulation through sleeves including specified finish.

.7 Cut back covering on strainers and finish off to expose removable head insulation.

.8 Cover expansion joints first with 24gauge (0.7mm) galvanized metal sleeve and then insulate to provide equivalent thickness to that on adjoining pipe.

.9 Protect insulation with protection saddles where insulated pipe is supported by rollers.

.10 Insulate pipe hangers supporting new piping carrying water at 70F (21C) or less to prevent condensation. Extend insulating material along hanger rod to height 4 times thickness of insulation. Seal insulation with vapour proof sealant.

.11 Extend pipe insulation and covering through walls, floors, ceilings, and concrete beams, unless indicated otherwise on drawings. protect exposed insulation extending through floors with 4" (100mm) wide strip of 18gauge (1.3mm) galvanized iron.

.12 Pack annular space between pipe sleeves and piping or pipe covering with glass fibre insulation or rock-wool insulation. In fire rated assemblies use Dow Silicon RTV or other ULC listed materials. Seal exposed insulation with mastic.

.13 Recover exposed surfaces of insulated piping installed in exposed areas, mechanical rooms, and equipment rooms with PVC jacketing and PVC fitting covers installed in accordance with manufacturer’s instructions.

.14 Insulate and cover exposed surfaces of waste connections, traps, hot and cold supply risers and valves at each lavatory and sink designated for "handicapped" or "barrier free" use with: PVC insulated fitting covers specifically designed for this application. Vinyl material is not to exceed flame spread rating of 150, and if intended to be used in high buildings, its smoke developed classification does not exceed 300. Zeston or other equivalent material, or foamed plastic type insulation finished with two coats of Armstrong Armflex or other equivalent material.

3.5 UNDERGROUND INSULATION

.1 Install insulation underground where and as indicated and in accordance with manufacturer's recommended installation instructions.

.2 All piping shall be cleaned of foreign substances and free of surface moisture prior to and during application of insulation and coverings.

.3 Ensure that all weld beads are ground smooth with the surface of the pipe prior to application of the insulation.

.4 Insulation thickness:

Service	Thickness
Domestic cold water	1in. (25mm)
Hot water	2in. (50mm)
Hydronic Heating Supply and Return	2in. (50mm)

.5 Preparation:

.1 After the nominal system diameter is determined (pipe diameter plus insulation thickness), the trench shall be excavated to allow 6" (150mm) minimum clearance in all directions around the final system.

.2 The bottom of the trench shall be graded to the design slope of the piping and to provide uniform bearing along its entire length. Where wet or unstable soils are encountered,

such soil shall be removed to a sufficient depth and the trench backfilled with coarse sand or loose granular earth.

.3 This backfill shall be compacted to a density equal to that of the acceptable portions of the trench where excavation of rock is required, the rock shall be excavated to an over depth of 6" (150mm) minimum below the specified trench depth. Over depths in rock shall be backfilled with loose granular earth or coarse sand and thoroughly tamped.

.4 In areas of high water table, adequate drainage shall be provided by a gravel bed and a perforated drain pipe covered with synthetic drainage fabric to prevent clogging. The pipe shall lead to a sump provided with means to remove water from the trench area.

.5 All insulated piping shall rest in a 6" (150mm) layer of compacted sand. Excavation shall be kept free of standing water during insulation and jacketing application.

.6 Where excessive or cyclical movement is anticipated, the bore of FOAMGLAS® insulation shall be coated with a thin application of bore coating and allowed to dry before insulation is applied to the pipe.

.6 Insulation Application:

.1 Insulation and jacketing shall be applied to piping in 10' (3m) segments (maximum length). After completion, the segments are rotated 180° and the bottom of the jacketing and butt strips are inspected for proper application an sealing. If any defects are visible, they must be corrected. Major defects may require removal of jacketing. Assuming proper jacketing and sealing, the segments are rotated back into position and the connecting butt strips are applied.

.1 Field jacketed insulation --staggered joints: the last section of pipe covering the 10' (3m) segment is cut even to form a through joint between completed segments.

.2 Large diameter piping: shorter segments can be insulated and jacketed if more practical.

.3 Abrasion: Insulation sections for large diameter piping will have to be bore coated.

.4 Special considerations - anchors, guides, expansion loops, elbows, etc.: the completed insulated segment is rotated and inspected before installing the connecting section of insulation at the anchors, guides, expansion loops, elbows, etc. These procedures are not to be used on oversized insulation. .

.2 Field-Jacketed: Field-jacketed insulation shall be applied to the piping with butt joints staggered and tightly butted. Longitudinal and butt joints shall be left dry. All joints shall be tightly fitted to eliminate voids by refitting or replacing sections of insulation. Each section of insulation shall be held in place by two wraps of strapping tape with a 50% overlap per wrap. For double-layer applications, the second layer of insulation shall be applied in a manner similar to the first, with all joints staggered between layers. .

.3 Factory-Jacketed: Insulation which has been pre-jacketed with jacketing shall be applied joint-to-joint with all joints tightly butted. Strapping staples may be used over the jacketing to temporarily secure the insulation until longitudinal laps are sealed and butt strips applied.

.4 Pre-Insulation of Pipe: Where conditions permit, insulation and jacketing may be applied outside of the trench to sections of piping. Pipe lengths should be insulated in segments. Length of insulation segment should not exceed 10' (3m). Leave un-insulated spaces between segments to allow for placement of slings by which the pipe can be lowered into the trench. The use of a spreader bar with two slings or more is recommended. The quantity and location of sling placement shall be determined by the design professional to avoid excessive deflection, and facilitate proper control of the pipe length during transfer. After the sections of pipe are in place in the trench, and ends of the sections secured, insulation and jacketing shall be applied to the joint areas and un-insulated spaces that

were not completed above ground. Adequate working space should be maintained for installation personnel.

.7 Jacketing Application:

.1 Apply the specified jacketing in strict accordance with the appropriate product data sheet. Seal all overlaps and butt strips as noted in the product data sheet to ensure that ground water cannot penetrate the jacket system.

.2 Irregular Surfaces:

.1 At all irregular surfaces such as elbows, tees, fitting covers, etc., the jacketing shall be pre-cut to fit the contour of the surface to which it is to be applied. Pre-cut sections shall allow for 2" (50mm) overlap. All laps shall be sealed. In addition to sealing the jacketing on these irregular surfaces, a glove coat of the coating shall be applied over the jacketing. First, carefully burn away the exterior plastic film on the jacketing. Then apply a glove coat. While still tacky, embed a layer of reinforcing fabric in the coating. After one hour, apply a second coat over the first coat. Total wet film thickness of the two coats should be 1/8" (3mm) minimum.

.2 As an alternative to the cutting and fitting of the jacketing on fittings, a five-layer application may be used. The coating shall be applied in accordance with the manufacturer’s recommendations, in alternating layers of mastic, reinforcing fabric, mastic, mastic fabric and mastic, totalling five layers. Total wet film thickness shall be 1/4" (6mm) minimum.

.3 If backfilling takes place less than 24 hours after the coating is applied, roofing felt shall be placed over the coating before backfilling.

.4 Ends and bore of insulation left exposed at day's end shall be sealed between the insulation and the pipe to prevent bulk water entry.

.5 All completed work shall be backfilled as soon as possible to prevent damage to the insulation system.

.8 Field Quality Control: After application of the jacketing system to all straight and irregular sections of insulation, visually inspect all laps, seams, butt strips and glove-coated areas to ensure that these areas are sealed from water entry in accordance with the specifications and appropriate product data sheets.

.9 Backfilling: The trench shall be carefully backfilled using the excavated earth approved for backfilling, consisting of sand, clay, earth, loam or other approved materials. Sand backfill shall be placed within 6" (150mm) of the insulated pipe and shall be free of rocks, debris or stones greater than 1/4" (6mm) diameter. Care shall be taken not to damage jacketing during backfilling. Backfill shall be applied in 6" (150mm) lifts, tamping each lift until a depth of 1' (300mm) over the insulated pipe is reached. The remainder of the trench shall be backfilled in 1' (300mm) lifts, with each lift tamped to the desired compaction.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Ductwork insulation

.2 Duct liner

.3 Insulation jackets

1.3 REFERENCES

.1 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

.2 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.

.3 ASTM C553 - Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.4 ASTM C612 - Standard Specification for Mineral Fibre Block and Board Thermal Insulation.

.5 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

.6 ASTM C1071 - Fibrous Glass Duct Lining Insulation(Thermal Sound Absorbing Material).

.7 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.8 ASTM E96 - Water Vapour Transmission of Materials.

.9 ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

.10 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.11 NAIMA National Insulation Standards.

.12 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

.13 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.14 UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

.15 CGSB-Canadian General Standards Board.

.16 CAN/CGSB-51.9 Mineral Fibre Thermal Insulation for Piping and Round Ducting.

.17 CAN/CGSB-51.10 Mineral Fibre Board Thermal Insulation

.18 CAN/CGSB-51.11 Mineral Fibre Thermal Insulation Blanket.

.19 CAN/CGSB-5140 Mineral Insulation, Flexible, Elastomeric, Unicellular, Sheet & Pipe Cover-up.

.20 CAN/CGSB-51-GP-52 Ma Vapour Barrier, Jacket and Facing Material for Pipe, Duct & Equipment Thermal Insulation.

1.4 QUALITY ASSURANCE

.1 Materials: Flame spread/smoke developed rating of 25/50 or less to ULC S102 and ASTM E84.

1.5 QUALIFICATIONS

.1 Applicator: Company specializing in performing the work of this section with minimum three (3) years experience.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Transport, handle, store, and protect products.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

.3 Store insulation in original wrapping and protect from weather and construction traffic.

.4 Protect insulation against dirt, water, chemical, and mechanical damage.

1.7 SUBMITTALS

.1 Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

.2 Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

.2 Maintain temperature during and after installation for minimum period of 24 hours.

2 Products

2.1 GLASS FIBRE, FLEXIBLE

.1 Manufacturer: Owens Corning Fiberglas

.2 Other acceptable manufacturers offering equivalent products:

.1 Manson

.2 Knauf Fiber Glass

.3 Schuller

.3 Insulation: ASTM C553; flexible, non-combustible blanket.

.1 'ksi' value : ASTM C518,0.045 at 75.2F (24C).

.2 Maximum service temperature: 250F (121C).

.3 Maximum moisture absorption: 0.20% by volume.

.4 Density: 24kg/cu.m.

.4 Vapour Barrier Jacket:

.1 Kraft paper with glass fibre yarn and bonded to aluminized film.

.2 Moisture vapour transmission: ASTM E96; 0.02 perm.

.3 Secure with pressure sensitive tape.

.5 Vapour Barrier Tape: Kraft paper reinforced with glass fibre yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

.6 Outdoor Vapour Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black colour.

.7 Tie Wire: Annealed steel, 1/16" (1.5mm).

2.2 GLASS FIBRE, RIGID

.1 Manufacturer: Owens Corning Fiberglas Model Vapour-Seal.

.2 Other acceptable manufacturers offering equivalent products: .

.1 Manson

.2 Knauf Fiber Glass .

.3 Schuller

.3 Insulation: ASTM C612; rigid, non-combustible blanket. .

.1 'ksi' value : ASTM C518,0.036 at 75.2F (24C).

.2 Maximum service temperature: 250F (121C).

.3 Maximum moisture absorption: 0.20% by volume.

.4 Density: 48kg/cu m.

.4 Vapour Barrier Jacket:

.1 Kraft paper with glass fibre yarn and bonded to aluminized film.

.2 Moisture vapour transmission: ASTM E96; 0.04 perm.

.3 Secure with pressure sensitive tape.

2.3 JACKETS

.1 Canvas Jacket: UL listed.

.1 Fabric: ASTM C921, 220g/sq m, plain weave cotton treated with dilute fire retardant lagging adhesive.

.2 Lagging Adhesive: Compatible with insulation.

.2 Mineral Fibre (Outdoor) Jacket: Asphalt impregnated and coated sheet, 2.45kg/sq m.

.3 PVC Jacket (Indoor):

.1 Jacket: ASTM C921, One piece sheet material.

.1 Minimum Service Temperature: -31F (-35C).

.2 Maximum Service Temperature: 150F (66C).

.3 Moisture Vapour Transmission: ASTM E96; 0.03perm ins.

.4 Maximum Flame Spread: ASTM E84; 25 or less.

.5 Maximum Smoke Developed: ASTM E84; 50 or less.

.6 Thickness: 20mil (0.4mm) minimum.

.2 Colour: standard off-white.

.3 Covering Adhesive Mastic: Compatible with insulation, maximum VOC content of 50g/L.

.4 Manufacturer;

.1 Ceel-Co 300 series

.2 Speedline Smoke Safe

.3 Aluminum Jacket: ASTM B209M. .1 Thickness: 0.40mm sheet. .2 Finish: Smooth. .3 Joining: Longitudinal slip joints and 2" (50mm) laps.

.4 Fittings: 0.4mm thick die shaped fitting covers with factory attached protective liner. .

.5 Metal Jacket Bands: 3/8" (10mm) wide; 0.015" (0.38mm) thick aluminum.

2.4 ACCESSORIES

.1 Adhesives and finishes shall be as recommended by the insulation manufacturer and shall comply with Section 23 10 00. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings specified. .

.2 Vapour retarder lap adhesive shall be water based, fire retardant

.3 Tapes shall be of cloth reinforced aluminum, soft adhesive with minimum 2" (50mm) width.

.4 Tie wire shall be of 1/16" (1.5mm) ø stainless steel.

.5 Fasteners shall be of 1/8" (4mm) Ø pins, with 35mm square clips. Clip length to suit insulation thickness.

.6 Bands shall be 1/2" (12mm) wide 1/4" (6mm) thick galvanized steel.

.7 Facing shall be of 1" (25mm) galvanized steel hexagonal wire mesh attached on both faces of insulation.

3 Execution

3.1 EXAMINATION

.1 Verify that ductwork has been tested before applying insulation materials

.2 Apply insulation after the required tests have been completed and approved by the Consultant.

.3 Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

.1 Install insulation to TIAC National Installation Standards.

.2 Apply insulation materials, accessories, jackets and finishes in accordance with manufacturer's written instructions and as specified.

.3 Insulated ductwork conveying air above ambient temperature:

.1 Provide with or without standard vapour barrier jacket.

.2 Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

.4 Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces below 3m (10’-0”) above finished floor: Finish with canvas jacket sized for finish painting.

.5 Duct and Plenum Liner Application:

.1 Adhere insulation with adhesive for 90% coverage.

.2 Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.

.3 Seal and smooth joints. Seal and coat transverse joints.

.4 Seal liner surface penetrations with adhesive.

.5 Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 TOLERANCE

.1 Substituted insulation materials: Thermal resistance within 10% at normal conditions, as materials indicated.

3.4 DUCT INSULATION

.1 Insulate new ductwork as follows:

Service	Type	Insulation Thickness ins. (mm)
Air supply rectangular	Rigid	1 (25)
Air supply round	Flexible	1 (25)
Exhaust 72” (2.0m) from outside rectangular	Rigid	3 (75)
Exhaust 72” (2.0m) from outside round	Flexible	3 (75)
Fresh air intake rectangular	Rigid	3 (75)
Exhaust air plenum	Rigid	3 (75)

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Equipment insulation

.2 Covering

1.3 REFERENCES

.1 ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

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

.4 ASTM C195 - Mineral Fibre Thermal Insulating Cement.

.5 ASTM C449/C449M - Mineral Fibre Hydraulic-Setting Thermal Insulating and Finishing Cement.

.6 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.

.7 ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

.8 ASTM C553 - Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.9 ASTM C592 - Mineral Fibre Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

.10 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

.11 ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

.12 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

.13 ASTM E96 - Water Vapour Transmission of Materials.

.14 NAIMA National Insulation Standards.

.15 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

.16 UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

.17 CAN/CG5B-51.11 Mineral Fibre Thermal Insulation Blanket.

.18 CAN/CG5B-51-GP-52 Ma Vapour Barrier, Jacket & Facing Material For Pipe Duct & Equipment Thermal Insulation.

.19 CAN/CG5B-51-GP-53 M Jacketing, Polyvinyl Chloride Sheet for Insulating Pipes, Vessels of Round Ducts

1.4 QUALITY ASSURANCE

.1 Materials: Flame spread/smoke developed rating of 25/50 or less to ULC S102 and ASTM E84.

1.5 QUALIFICATIONS

.1 Applicator: Company specializing in performing the work of this section with minimum three (3) years experience.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Transport, handle, store, and protect products.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

.3 Store insulation in original wrapping and protect from weather and construction traffic.

.4 Protect insulation against dirt, water, chemical, and mechanical damage.

1.7 SHOP DRAWINGS

.1 Product Data: Provide product description, list of materials and thickness for each service, and locations.

.2 Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

.2 Maintain temperature during and after installation for minimum period of 24 hours.

2 Products

2.1 GLASS FIBRE, FLEXIBLE

.1 Manufacturer: Owens Corning Fiberglass

.2 Other acceptable manufacturers offering equivalent products:

.1 Manson

.2 Knauf Fiber Glass

.3 Schuller

.3 Insulation: ASTM C553; flexible, non-combustible blanket.

.1 'ksi' value : ASTM C518,0.045 at 75.2F (24C).

.2 Maximum service temperature: 250F (121C).

.3 Maximum moisture absorption: 0.20% by volume.

.4 Density: 16kg/cu.m.

.4 Vapour Barrier Jacket:

.1 ASTM C921,

.2 Moisture vapour transmission: ASTM E96; 0.02 perm.

.3 Secure with self-sealing longitudinal laps and butt strips.

.4 Secure with outward clinch expanding staples and vapour barrier mastic.

.5 Tie Wire: 3/64" (1.22mm) stainless steel with twisted ends on maximum 12" (300mm) centres.

.6 Vapour Barrier Lap Adhesive: Compatible with insulation, maximum VOC content of 80g/L.

.7 Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool, maximum VOC content of 80g/L.

.8 Taps shall be of aluminum, self adhesive with minimum 2" (50mm) width.

2.2 ELASTOMERIC INSULATION

.1 Acceptable Manufacturers:

.1 Armacell APArmaflex

.2 APArmaflex W

.3 APArmaflex SS

.4 APArmaflex SA

.2 Insulation material shall be a flexible, closed-cell elastomeric insulation in tubular or sheet form to ASTM C 534, "Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form."

.3 Insulation materials shall have a closed-cell structure to prevent moisture from wicking.

.4 Insulation material shall be manufactured without the use of CFC's, HFC's or HCFC's, formaldehyde free, low VOC's, fibre free, dust free and shall resist mould and mildew.

.5 Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ULC S102, ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.

.6 Materials shall have a maximum thermal conductivity of 0.27Btu-in./h-ft2- °F at a 75F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.

.7 Materials shall have a maximum water vapour transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.

.8 The material shall be manufactured under an independent third party supervision testing program covering the properties of fire performance, thermal conductivity and water vapour transmission.

.9 Adhesives and finishes shall be as recommended by the insulation manufacturer and shall comply with Section 23 10 00. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings specified.

2.3 JACKETS

.1 PVC Jacket (Indoor):

.1 Jacket: ASTM C921, One piece sheet material.

.1 Minimum Service Temperature: -31F (-35C).

.2 Maximum Service Temperature: 150F (66C).

.3 Moisture Vapour Transmission: ASTM E96; 0.03perm ins.

.4 Maximum Flame Spread: ASTM E84; 25 or less.

.5 Maximum Smoke Developed: ASTM E84; 50 or less.

.6 Thickness: 20mil (0.4mm) minimum.

.2 Colour: standard off-white.

.3 Covering Adhesive Mastic: Compatible with insulation, maximum VOC content of 50g/L.

.4 Manufacturer;

.1 Ceel-Co 300 series

.2 Speedline Smoke Safe

2.4 ACCESSORIES

.1 Adhesives and finishes shall be as recommended by the insulation manufacturer and shall comply with Section 23 10 00. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings specified.

.2 Vapour retarder lap adhesive shall be water based, fire retardant

.3 Tapes shall be of cloth reinforced aluminum, soft adhesive with minimum 2" (50mm) width.

.4 Tie wire shall be of 1/16" (1.5mm) ø stainless steel.

.5 Fasteners shall be of 1/8" (4mm) Ø pins, with 35mm square clips. Clip length to suit insulation thickness.

.6 Bands shall be 1/2" (12mm) wide 1/4" (6mm) thick galvanized steel.

.7 Facing shall be of 1" (25mm) galvanized steel hexagonal wire mesh attached on both faces of insulation.

3 Execution

3.1 EXAMINATION

.1 Apply insulation after the required tests have been completed and approved by the Consultant.

.2 Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

.1 Install piping insulations to TIAC National Installation Standards.

.2 Apply insulation materials, accessories, jackets and finishes in accordance with manufacturer's written instructions and as specified.

.3 Do not insulate factory insulated equipment.

.4 Exposed Equipment: Locate insulation and cover seams in least visible locations.

.5 Apply insulation close to equipment by grooving, scoring, and bevelling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

.6 Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapour barrier cement.

.7 Insulated equipment containing fluids below ambient temperature: Insulate entire system.

.8 Fibre glass insulated equipment containing fluids below ambient temperature: Provide vapour barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapour barrier adhesive.

.9 For hot equipment containing fluids 140F (60C) or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

.10 For hot equipment containing fluids over 140F (60C), insulate flanges and unions with removable sections and jackets.

.11 Fibre glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapour barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

.12 Inserts and Shields:

.1 Application: Equipment 1-1/2 " (38mm) diameter or larger.

.2 Shields: Galvanized steel between hangers and inserts.

.3 Insert location: Between support shield and equipment and under the finish jacket.

.4 Insert configuration: Minimum 6" (150mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

.5 Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

.13 Finish insulation at supports, protrusions, and interruptions.

.14 Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket.

.15 Exterior Applications: Provide vapour barrier jacket or finish with glass mesh reinforced vapour barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.

.16 Cover glass fibre insulation with metal mesh and finish with heavy coat of insulating cement.

.17 Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

.18 Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 TOLERANCE

.1 Substituted insulation materials: Thermal resistance within 10% at normal conditions, as materials indicated.

3.4 EQUIPMENT INSULATION

.1 Insulate equipment as follows:

Mineral Fibre Blanket – Hot Surfaces 20C to 400C Item	**Thickness ins (mm)**
Heating glycol pumps along with fittings and accessories	2 (50)
Expansion tanks, air separators	2 (50)
Any other equipment operating at a high temperature	2 (50)
Flexible Elastomeric Unicellular Sheet – Cold Surfaces Item	**Thickness ins (mm)**
Water meter	1 (25)
Any other equipment operating at low temperature	1-1/2 (38)

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Pipe and pipe fittings for:

.1 Heating water piping system.

.2 Glycol/water piping system.

.2 Equipment drains and overflows and Valves:

.1 Gate valves, Globe or angle valves.

.2 Ball valves.

.3 Butterfly valves.

.4 Check valves.

.5 Circuit balancing valves.

.6 Drain valves.

1.3 REFERENCES

.1 ASME -Welding and Brazing Qualifications.

.2 ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.

.3 ASME B16.5 Pipe Pumps & Fittings.

.4 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

.5 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.6 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.

.7 ASME B31.1 - Code for Power Piping.

.8 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.9 A183 Carbon Steel Track Bolts and Nuts.

.10 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.11 ASTM B32 - Solder Metal.

.12 ASTM B88 - Seamless Copper Water Tube.

.13 ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.14 ASTM D2235 - Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.15 ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).

.16 ASTM D2310 - Machine-Made Fibreglass' (Glass Fibre-Reinforced Thermosetting Resin) Pipe.

.17 ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

.18 ASTM D2467 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

.19 ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.

.20 ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

.21 ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

.22 ASTM D2855 - Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

.23 ASTM D3309 - Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems.

.24 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.25 ASTM F708 - Design and Installation of Rigid Pipe Hangers.

.26 ASTM F876 - Crosslinked Polyethylene (PEX) Tubing.

.27 ASTM F877 - Crosslinked Polyethylene (PEX) Plastic Hot - and Cold - Water Distribution Systems.

.28 AWS A5.8 - Filler Metals for Brazing and Braze Welding.

.29 AWS D1.1 - Structural Welding Code - Steel.

.30 AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

.31 AWWA C110 - Ductile - Iron and Grey -Iron Fittings 3” – 48” (75mm - 1200mm), for Water and Other Liquids.

.32 AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Pressure Pipe and Fittings.

.33 AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water.

.34 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacture.

.35 MSS SP69 - Pipe Hangers and Supports - Selection and Application.

.36 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.4 SUBMITTALS

.1 Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

.2 Welders Certificate: Include welder’s certification of compliance with ASME SEC 9.

.3 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

.3 Welders: Certified to ASME SEC 9.

1.6 REGULATORY REQUIREMENTS

.1 Conform to ASME B31.9 code for installation of piping system.

.2 Welding Materials and Procedures: Conform to ASME SEC 9 and applicable provincial labour regulations.

.3 Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Accept valves on site in shipping containers with labelling in place. Inspect for damage.

.2 Provide temporary protective coating on cast iron and steel valves.

.3 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

.4 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install underground piping when bedding is wet or frozen.

1.9 EXTRA MATERIALS

.1 Provide two repacking kits for each size and valve type.

2 Products

2.1 VALVES – GENERAL

.1 Conform to requirements of ANSI, ASTM, ASME, and applicable MSS standards.

.2 Provide valves of the same manufacturer where possible.

.3 Manufacturer's name and pressure rating clearly marked on body to MSS-SP-25.

.4 Valid CRN (Canadian Registration Number) required for each valve.

.5 Materials:

.1 Bronze: ASTM B62 or B61 as applicable

.2 Brass: ASTM B283 C3770

.3 Cast Iron: ASTM A126 Class B

.6 End Connections:

.1 Threaded ends: ANSI B1.20.1

.2 Flanged ends: ANSI B16.1 (Class 125), ANSI B16.5

.3 Face-to-face dimensions: ANSI B16.10

.7 Design and Testing:

.1 Bronze Gate & Check valves: MSS-SP-80

.2 Ball Valves: MSS-SP-110

.3 Cast Iron Gate Valves: MSS-SP-70

.4 Cast Iron Globe Valves: MSS-SP-85

.5 Cast Iron Check: MSS-SP-71

.6 Butterfly Valves: MSS-SP-67

.8 First named product as indicated in paragraphs below; other acceptable manufacturers, subject to equivalent products include:

.1 Kitz.

.2 Crane/Jenkins

.3 Conbraco

.4 Nibco

2.2 HYDRONIC SYSTEMS TO 150PSIG – ABOVEGROUND

.1 Nominal Operating Pressure 125psig

.2 Design Pressure 150psig

.3 Test Pressure 225psig

.4 Design Temperature 350F

.5 Corrosion Allowance 0.0625in.

.6 Steel Pipe ASTM A53 Gr. B or ASTM A106 Gr. B, schedule 40, black steel, seamless

.7 Joints, 2" and smaller screwed

.8 Screwed Fittings 150lb. malleable iron

.9 Unions Cl.150, ASTM A-47 malleable iron, ASTM A-153 galvanized, ANSI B2.1 threads.

.10 Joints, 2-1/2" (65mm) and larger welded, with flanges at connections to equipment

.11 Butt weld fittings ASTM A234 Gr. WFB

.12 Flanges ASTM A105, Class 150, raised face, weld neck or slip on

.13 Bolts ASTM A307 C.S. bolts, sq. head; ASTM A563 nuts, hex head

.14 Gaskets 1/16" (1.6mm) thick preformed non-asbestos graphite fibre.

.15 Copper Tubing, 2" (50mm) and Smaller ASTM B88, Type L, hard drawn.

.16 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 220C to 280C.

.17 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper

.18 Dielectric Unions Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

.19 Valves, 2" (50mm) and smaller ASTM A105

.1 Gate Valves (Isolating) 300psig non-shock WOG, ASTM B62 bronze body, solid wedge disc, rising stem, bronze trim, threaded ends, Kitz #25.

.2 Globe Valves (Throttling) 300psig non-shock WOG, ASTM B62 bronze body, composition (Teflon) disc, rising stem, bronze trim, threaded ends, Kitz #09.

.3 Check Valves (Backflow) 300psig non-shock WOG, ASTM B62 bronze body, Y-pattern horizontal, swing type disc, threaded ends, Kitz #29.

.4 Ball Valves (Drain) 600psig non-shock WOG, forged brass, 2-piece, chrome ball and stem, full port, blow-out proof PTFE seats & stem, lever handle, threaded ends, Kitz #68AC.

.20 Provide stem extensions for insulated piping.

.21 Provide gear operator and chain on valves installed above 10-ft AFF.

.22 Strainers, 2" (50mm) and smaller Class 250, 400psig WOG, cast iron body, Y-pattern, screwed cap and ends, A167 304 stainless steel screen with 1/32" perforations. Mueller Steam 11M.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

.1 Copper Tubing: ASTM B88, Type M and DWV, hard drawn.

.1 Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.

.2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 428F to 536F (220C to 280C).

2.4 CIRCUIT BALANCING VALVES

.1 Circuit Balancing Valves; 2" (50mm) and smaller.

.1 Screwed connection, globe style design, nonferrous, pressure die-cast, nonporous Ametal Copper Alloy. Each valve shall be such that when installed in any direction, it will not affect flow measurement.

.2 Valves shall provide the following functions:

.1 Precise flow measurement.

.2 Precision flow balancing.

.3 Positive shut off with no drip seat and teflon disc.

.4 Drain connection with protective cap.

.3 Valves shall have four 360° adjustment turns of hand wheel for maximum vernier-type setting with "Hidden Memory" feature to program the valve with precision tamper-proof balancing setting.

.4 Valves shall be shipped in a 4.5 R factor polyurethane container that shall be used as insulation after valve in installed.

.5 Provide valves suitable for maximum working pressure of 250psi (1720kPa) and maximum operating temperature of 250F (121C).

.6 Acceptable Products: S.A. Armstrong CRV I indicated or Tour & Anderson STA-D or Newman Hattersley.

3 Execution

3.1 PREPARATION

.1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

.2 Remove scale and dirt on inside and outside before assembly.

.3 Prepare piping connections to equipment with flanges or unions.

.4 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

.5 After completion, fill, clean, and treat systems.

3.2 APPLICATIONS

.1 Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

.2 Where permitted, install grooved mechanical couplings and fasteners in accessible locations.

.3 Install unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

.4 Provide non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

.5 Provide pipe hangers and supports to CSA B51 unless indicated otherwise.

.6 Use gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

.7 Use globe valves for throttling, bypass, manual flow control services, for balancing & in bypass around control valves.

.8 Use spring loaded check valves on discharge of condenser water pumps.

.9 Use wafer check valves where required to suit space and or weight limitations.

.10 Use 3/4" (19mm) gate or ball valves with cap and chain for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

.11 Use lug end butterfly valves to isolate equipment.

.12 Butterfly valves may be used for isolation and throttling duty for large pipe sizes 2-1/2" (65mm) and above.

.13 Gasket material shall be Grade 'E' EPDM compound conforming of ASTM D2-2000 and suitable for an operating temperature range of -34C to 110C.

.14 Small run outs, size 3/4" (19mm) and less for extension of domestic make-up piping may be constructed using hand drawn copper tube type 'K' or "L" and comply to ASTM B88.

3.3 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Install heating water, glycol, chilled water, condenser water piping to CSA B51.

.3 Route piping in orderly manner, parallel to building structure, and maintain gradient.

.4 Install piping to conserve building space, and not interfere with use of space.

.5 Group piping whenever practical at common elevations.

.6 Sleeve pipe passing through partitions, walls and floors.

.7 Slope piping and arrange to drain at low points.

.8 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

.9 Inserts:

.1 Provide inserts for placement in concrete formwork.

.2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

.3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4" (100mm).

.4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

.5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

.10 Pipe Hangers and Supports:

.1 Install to CSA B51.

.2 Support horizontal piping as scheduled.

.3 Install hangers to provide minimum 1/2" (13mm) space between finished covering and adjacent work.

.4 Place hangers within 12" (300mm) of each horizontal elbow.

.5 Use hangers with 1-1/2" (38mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

.6 Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Provide copper plated hangers and supports for copper piping.

.9 Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

.11 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

.12 Provide access where valves and fittings are not exposed.

.13 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

.14 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer (VOC content not to exceed 250g/L) to welds.

.15 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

.16 Install valves with stems upright or horizontal, not inverted.

.17 Air vents shall be selected to suit the system operating pressures and shall be automatic and complete with isolating valves.

.18 All strainers 1-1/2" (38mm) & larger shall be fitted with chain valves.

.19 Unless specified otherwise, drain piping shall be sloped down in the direction of flow not less than 1" in 40 feet.

.20 Eccentric reducers shall be provided to keep the bottom of sloped piping aligned in order to minimize risk of water hammer and to facilitate drainage.

.21 Valves shall be installed with stems upright or angled 45 deg. above horizontal unless instructed otherwise.

.22 Pipe all discharge from temp. & safety relief valves to a point of safe discharge directly into a floor drain, hub drain or safe outdoor location.

3.4 EQUIPMENT CONNECTIONS

.1 Install unions or flanges at connections to all equipment and specialty components.

.2 Arrange piping connections to allow ease of access and removal of equipment.

.3 Align and independently support piping adjacent to equipment connections in order to prevent piping stresses from being transferred to equipment.

.4 Piping reducers shall be used where equipment connections differ from pipe sizes indicated. The use of bushings will not be permitted.

.5 Install removable sections of pipe 12" (300mm) spool pieces on the suction side of pumps and where needed for ease of maintenance.

3.5 VALVES, COCKS AND FAUCETS

.1 Use valves of line size unless noted otherwise.

.2 Provide isolating valves in each branch from the main line and where indicated.

.3 Provide isolating valves at all equipment connections.

.4 Provide globe valves or ball valves complete with memory stop at the discharge of each pump and where valves are used for regulating or throttling purposes.

.5 Provide 1/2" (13mm) brass hose bibbs at all low points of each system, where the system cannot be drained through the main floor or return piping.

.6 Where new valves are installed to replace existing valves and it is impractical to shut-down and drain the entire system, valves shall be replaced using pipe freezing techniques.

3.6 HYDRONIC SPECIALTIES

.1 Air Vents

.1 Provide 1" (25mm) diameter air vent chamber at each riser feeding terminal units. Install chambers as high as possible within unit, and provide manual air vent connected to air chamber by flexible tubing.

.2 Provide a float type automatic air vent at any high points of hot water supply and return piping not vented through a convector etc. and at high point of piping for each hot water coil. The discharge of air vent shall terminate over a floor drain in mechanical rooms or over a sink in service rooms. A shut-off valve shall be provided on each automatic air vent and an access door and frame shall be provided for air vents located above ceilings.

.2 Automatic Feed Valves: provide automatic feed valve on the cold water make-up line to each new hot water heating system.

.3 Air Cushion Tanks

.1 Provide air cushion tanks of size noted where indicated.

.2 Provide housekeeping pad for floor mounting of tank.

.3 Terminate drain out line at nearest funnel floor drain, or service sink.

.4 Adjust charge to system static pressure at point of connection plus 5psi (35kPa).

.4 Air Eliminators: provide an air eliminator at each new air cushion (expansion) tank.

.5 Circuit Balancing Valve (CBV): provide a CBV in each branch serving a heating and/or cooling terminal unit and where indicated on drawings. Installation shall be in accordance with manufacturer's installation instructions. Ensure that manufacturer's recommended clearances are maintained to minimize turbulence and to promote accuracy.

3.7 TESTING AND INSPECTION

.1 Test liquid heat transfer piping hydrostatically at not less than 150% of operating pressure or not less than 125psi (860kPa) whichever is the greater. Test period shall be not less than six (6) hours duration during which time each joint shall be inspected, given a sharp tap with a hammer and checked for leaks.

.2 Arrange and pay for inspection by authorities having jurisdiction.

3.8 ADJUSTING AND BALANCING

.1 Instruments used for this work shall be accurately calibrated and maintained in good working order, and shall include:

.1 One set of pressure gauges and fittings.

.2 Dry bulb thermometer.

.3 Wet bulb thermometer.

.4 Thermocouple unit and thermocouple.

.5 Set of balancing cock adjustment wrenches.

.6 Portable field flow meter.

.2 Prepare the liquid heat transfer systems as follows:

.1 Install any additional devices required for effective balancing as advised by the Systems Verification Agency.

.2 Open all valves, and return line balancing cocks.

.3 Remove and clean all strainers.

.4 Check pump rotation.

.5 Check expansion tanks to make sure they are not air bound and that the system is full of water.

.6 Check all air vents at high points of water systems to make sure they are installed properly and are operating freely. Make certain all air is removed from circulating system.

.7 Set all temperature controls so that all coils are calling for full cooling. This should close all automatic bypass valves at coil and chillers. To balance hot water coils, set systems to call for full heating.

.8 Check operation of automatic bypass valve.

.9 Check and set operating temperature of heat exchangers to design requirements.

.3 Balance the liquid heat transfer systems as follows:

.1 Complete air balance must have been accomplished before water balance is begun.

.2 Set chilled water, hot water and glycol pumps to proper flow rate delivery.

.3 Adjust flow of hot water through heat exchangers.

.4 Check leaving water temperatures and return water temperatures, and pressure drop through heat exchangers. Reset to correct design temperatures.

.5 Check water temperature at inlet side of cooling and heating coils. Note rise or drop of temperatures from source.

.6 Balance each chilled water and hot water coil.

.7 Upon completion of flow readings and coil adjustments, mark all settings and record all data.

.8 After making adjustments to coils, recheck settings at pumps, and heat exchangers. Readjust if required.

.9 Install pressure gauges on each coil, then read pressure drop through coil at set flow rate on call for full cooling and full heating. Set pressure drop across bypass valve to match coil full flow pressure drop. This prevents unbalanced flow conditions when coils are on full bypass.

.10 Check and record the following items at each cooling and heating element:

.1 Inlet water and air temperature. .

.2 Leaving water and air temperature.

.3 Pressure drop of each coil. .

.4 Pump operating suction and discharge pressures and final total dynamic head.

.5 Pressure drop across bypass valve.

.6 All mechanical specifications of pumps.

.7 Rated and actual running amperage of pump motor.

.4 After completion of adjusting and balancing and submittal of records notify the Systems Verification Agency and the Consultant and assist in verifications. If systems fail verification, readjust and balance systems to the satisfaction of the Consultant.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Expansion tanks

.2 Air vents

.3 Strainers

.4 Pump suction fittings

.5 Combination fittings

.6 Control Valves

.7 Relief valves

.8 Glycol specialties

1.3 REFERENCES

.1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.

1.4 SUBMITTALS

.1 Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

.2 Submit inspection certificates for pressure vessels from TSSA.

.3 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Accept valves on site in shipping containers with labelling in place. Inspect for damage.

.2 Provide temporary protective coating on cast iron and steel valves.

.3 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

.4 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 MAINTENANCE SERVICE

.1 Provide service and maintenance of glycol system for one year from date of substantial completion.

.2 Monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

1.8 EXTRA MATERIALS

.1 Provide one extra 1gal. (4L) drum of propylene glycol.

2 Products

2.1 DIAPHRAGM TYPE EXPANSION TANK

.1 Manufacturers:

.1 S. A. Armstrong Amtrol Model AX-240.

.2 Other acceptable manufacturers offering equivalent products, subject to shop review.

.1 Expanflex.

.2 ITT Bell & Gosset.

.2 Construction: Welded steel, tested and stamped to ASME SEC 8-D; supplied with National Board Form U-1, rated for working pressure of 125psi (860kPa), with flexible butyl diaphragm sealed into tank , and steel support stand.

.3 Accessories: Pressure gauge and air-charging fitting, tank drain; pre-charge to 11psi (80kPa).

.4 Size: Refer to the schedule on the drawings.

2.2 AIR VENTS

.1 Manual Type: Short vertical sections of 2" (50mm) diameter pipe to form air chamber, with 3mm brass needle valve at top of chamber.

.2 Float Type:

.1 Manufacturers:

.1 S. A. Armstrong

.2 Amtrol.

.3 Taco.

.2 Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.3 STRAINERS

.1 Size 2" (50mm) and Under:

.1 Manufacturers:

.1 Sarco SB

.2 Crane

.3 Armstrong

.2 Screwed brass or iron body for 17 psi (1200kPa) working pressure, Y pattern with 0.8mm stainless steel perforated screen.

.2 Size 2-1/2" to 4" (65mm to 100mm):

.1 Flanged iron body for 175psi (1200kPa) working pressure, Y pattern with 1.2mm stainless steel perforated screen.

2.4 PUMP SUCTION FITTINGS

.1 Manufacturers:

.1 S. A. Armstrong

.2 Other acceptable manufacturers offering equivalent products, subject to shop drawing.

.1 ITT Bell & Gossett

.2 Fitting: Angle pattern, cast-iron body, threaded for 2" (50mm) and smaller, flanged for 2-1/2" (65mm) and larger, rated for 175psi (1200kPa) working pressure, with inlet vanes, cylinder strainer with 3/16" (5mm) diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

.3 Accessories: Adjustable foot support, blow down tapping in bottom, gauge tapping in side.

2.5 COMBINATION PUMP DISCHARGE VALVES

.1 Manufacturers:

.1 S. A. Armstrong.

.2 Other acceptable manufacturers offering equivalent products, subject to shop drawing review.

.1 ITT Bell & Gossett.

.2 Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175psi (1200kPa) operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.6 CONTROL VALVES

.1 All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the manufacturer, and shall be guaranteed to meet the heating loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this specification.

.2 Control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving variable flow systems shall be sized for a pressure drop equal to the actual coil pressure drop, but no less than 5 psi. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no less than 5 psi. Valves for terminal coils shall be sized for a 5 psig pressure drop, but no more than a 5 psi drop.

.3 Ball valves shall be used for hot water applications, duct heaters, unit heaters.

.4 Acceptable manufacturers: Johnson Controls

2.7 RELIEF VALVES

.1 Manufacturers:

.1 Sarco.

.2 Other acceptable manufacturers offering equivalent products.

.1 Watts

.2 ITT Bell & Gossett

.2 Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.8 GLYCOL SYSTEM

.1 Mixing Tank: 55gal. (205L) steel drum with fittings suitable for filling and hand pump for charging, rubber hose for connection of hand pump to system.

.2 Storage Tank: Closed type, welded steel constructed, tested and stamped to ASME SEC 8-D; 100psi (690kPa) rating; cleaned, prime coated, and supplied with steel support saddles. Construct with tappings for installation of accessories.

.3 Expansion Tank: Diaphragm type with vent fitting with air separator, and automatic air vent.

.4 Air Pressure Reducing Station: Pressure reducing valve with shut-off valves, strainer, check valve and needle valve bypass.

.5 Glycol Solution: Inhibited ethylene glycol and water solution mixed 40% glycol - 60% water, suitable for operating temperatures from -40F to 250F (-40C to 121C).

.6 Cold Water Fill Assembly: Strainer, isolation valves and air gap.

3 Execution

3.1 INSTALLATION

.1 Install specialties to manufacturer's instructions.

.2 Where large air quantities can accumulate, provide enlarged air collection standpipes.

.3 Provide manual air vents at system high points and as indicated.

.4 For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain for water systems and to holding tank for glycol/water systems.

.5 Provide automatic air vent on suction side of system circulation pumps.

.6 Provide valved drain and hose connection on strainer blow down connection.

.7 Provide pump suction fitting on suction side of base mounted centrifugal pumps . Remove temporary strainers after cleaning systems.

.8 Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

.9 Support pump fittings with floor mounted pipe and flange supports.

.10 Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

.11 System relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

.12 Pipe relief valve outlet to nearest floor drain for water systems and to holding tank for glycol/water systems.

.13 Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

.14 Clean and flush glycol system before adding glycol solution.

.15 Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at 12psi (80kPa).

.16 Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 In-line circulators

1.3 REFERENCES

.1 UL 778 - Motor-Operated Water Pumps.

1.4 SUBMITTALS

.1 Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

.2 Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

.3 Millwright's Certificate: Certify that base mounted pumps have been aligned.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years experience.

.2 Alignment: Align base mounted pumps by qualified millwright.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.7 PERFORMANCE REQUIREMENTS

.1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitations, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.

1.8 EXTRA MATERIALS

.1 Provide one set of mechanical seals for each pumps.

2 Products

2.1 MANUFACTURER'S

.1 ITT Bell & Gosset models and Grundfos models indicated.

.2 Other acceptable manufacturers offering equivalent products. Subject to shop drawing review.

.1 S. A. Armstrong

.2 Darling-Duro

.3 Refer to schedule on drawings.

2.2 IN-LINE CIRCULATORS

.1 Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125psi (860kPa) maximum working pressure.

.2 Casing: Cast iron, with flanged pump connections.

.3 Impeller: Cadmium plated steel, keyed to shaft.

.4 Bearings: Two, oil lubricated bronze sleeves.

.5 Shaft: Alloy or stainless steel with copper or bronze sleeve, integral thrust collar.

.6 Seal: Carbon rotating against a stationary ceramic seat, 225F (107C) maximum continuous operating temperature.

.7 Seal: Carbon rotating against a stationary ceramic seat, viton fitted, 275F (135C) maximum continuous operating temperature.

.8 Drive: Flexible coupling.

.9 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

.3 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings.

.4 Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

.5 Provide air cock and drain connection on horizontal pump casings.

.6 Provide drains for bases and seals, piped to and discharging into floor drains.

.7 Check, align, and certify alignment of base mounted pumps prior to start-up.

.8 Lubricate pumps before start-up.

.9 Provide side-stream filtration system for heating water systems. Install across pump with flow from pump discharge to pump suction from pump tappings.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Cleaning of pipe and fittings.

.2 Cleaning of equipment.

.3 Supply, installation testing and adjusting of chemical feed equipment.

.4 Chemical treatments of piping systems, boilers and cooling towers.

.5 Supply of chemicals.

1.3 SUBMITTALS

.1 Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

.2 Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

.3 Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

.4 Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

1.4 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience. Company to have local representatives with water analysis laboratories and full time service personnel.

.2 Installer: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.5 REGULATORY REQUIREMENTS

.1 Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for to public sewage systems.

.2 Products Requiring Electrical Connection: Listed and classified by CSA as suitable for the purpose specified and indicated.

1.6 MAINTENANCE MATERIALS

.1 Provide sufficient chemicals for treatment and testing during warranty period.

2 Products

2.1 MANUFACTURERS

.1 GE Water Tech (Dearborn)

.2 Buckman Laboratories

.3 Bird Archer

.4 Ashland Drew

2.2 MATERIALS

.1 System Cleaner:

.1 Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.

.2 Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

.2 Closed System Treatment (Water):

.1 Sequestering agent to reduce deposits and adjust pH; polyphosphate. .

.2 Corrosion inhibitors; liquid boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.

.3 Conductivity enhancers; phosphates or phosphonates.

2.3 BYPASS POT FEEDER

.1 2gal. (6.8L) quick opening cap for working pressure of 175psi (1200kPa).

2.4 SOLUTION METERING PUMP

.1 Positive displacement, diaphragm pump with adjustable flow rate, thermoplastic construction, continuous-duty fully enclosed electric motor and drive, and built-in relief valve.

.2 Electrical Characteristics:

.1 120volts, single phase, 60Hz.

.2 Cord and Plug: Provide unit with 6ft. (2m) cord and plug for connection to electric wiring system including grounding connector

2.5 SOLUTION TANKS

.1 30gal. (114L) capacity, polyethylene, self-supporting, 1gal. (3.8L) graduated markings; moulded fibreglass cover with recess for mounting pump, agitator, and liquid level switch.

2.6 AGITATOR

.1 Totally enclosed electric motor, cast iron clamp and motor mount, 1/2" (13mm) diameter coated Type 316 stainless steel propeller.

.2 Electrical Characteristics:

.1 120volts, single phase, 60Hz.

.2 Cord and Plug: Provide unit with 6ft. (2m) cord and plug for connection to electric wiring system including grounding connector.

2.7 TEST EQUIPMENT

.1 Provide white enamel test cabinet with local and fluorescent light, capable of accommodating 4 - 10ml zeroing titrating burettes and associated reagents.

.2 Provide the following test kits:

.1 Alkalinity titration test kit.

.2 Chloride titration test kit.

.3 Sulphite titration test kit.

.4 Total hardness titration test kit.

.5 Low phosphate test kit.

.6 Conductivity bridge, range 0 - 10,000 micro ohms.

.7 Creosol red pH slide complete with reagent.

.8 Portable electronic conductivity meter.

.9 High nitrite test kit.

3 Execution

3.1 PREPARATION

.1 Systems to be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

.2 Place terminal control valves in open position during cleaning.

.3 Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

.1 Concentration:

.1 As recommended by manufacturer.

.2 1kg per 1000L of water contained in the system.

.3 1kg per 1000L of water for hot systems and 1kg per 500L of water for cold systems.

.4 Fill steam boilers only with cleaner and water.

.2 Hot Water Heating Systems:

.1 Apply heat while circulating, slowly raising temperature to 160F (71°C) and maintain for 12hours minimum.

.2 Remove heat and circulate to 100F (37.8C) or less; drain systems as quickly as possible and refill with clean water.

.3 Circulate for 6 hours at design temperatures, then drain.

.4 Refill with clean water and repeat until system cleaner is removed.

.3 Use neutralizer agents on recommendation of system cleaner supplier and approval of Consultant.

.4 Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

.5 Remove, clean, and replace strainer screens.

.6 Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

.1 Install to manufacturer's instructions.

3.4 CLOSED SYSTEM TREATMENT

.1 Provide one bypass feeder on each system. Install isolating and drain valves and piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

.2 Introduce closed system treatment through bypass feeder when required or indicated by test.

.3 Provide 3/4" (19mm) water coupon rack around circulating pumps with space for 4 test specimens.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Propane Fired, Condensing Boilers.

1.3 REFERENCES

.1 AGA - Directory of Certified Appliances and Accessories.

.2 AGA Z21.13 - Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.3 ANSI Z21.13-[2004]/CSA 4.9-[2004], Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.4 ASME SEC 4 - Boiler and Pressure Vessel Codes - Rules for Construction of Heating Boilers.

.5 ASME SEC 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.

.6 CAN1-3.1-[77(R2001)], Industrial and Commercial Gas-Fired Package Boilers.

.7 CAN/CSA-B149.1-[05], Natural Gas and Propane Installation Code.

.8 CSA B51-[03], Boiler, Pressure Vessel, and Pressure Piping Code.

.9 HI (Hydronics Institute) - Testing and Rating Standard for Cast Iron and Steel Heating Boilers.

.10 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

.11 NFPA 54 (AGA Z223.1) - National Fuel Gas Code.

.12 NFPA 58 - Liquified Petroleum Gas Code.

.13 UL - Gas and Oil Equipment Directory.

1.4 SUBMITTALS

.1 Submit shop drawings for each major piece of equipment.

.2 Shop drawings shall include;

.1 Dimension drawings of water heaters indicating components and connections to other equipment and piping.

.2 Electrical characteristics and connection requirements.

.3 Performance data.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Provide equipment with the manufacturer's name, model number, and rating/capacity identified.

.3 Ensure products and installation of specified products are to recommendations and requirements of the following organizations:

.1 American Gas Association (AGA).

.2 National Sanitation Foundation (NSF).

.3 American Society of Mechanical Engineers (ASME).

.4 National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).

.5 National Electrical Manufacturers' Association (NEMA).

.6 Underwriters Laboratories (UL).

1.6 REGULATORY REQUIREMENTS

.1 Conform to applicable code for internal wiring of factory wired equipment.

.2 Conform to ASME SEC 4 and SEC 8D for boiler construction.

.3 Units: AGA certified.

.4 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Transport, handle, store, and protect products.

.2 Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

1.8 WARRANTY

.1 Provide five year manufacturer warranty on equipment.

2 Products

2.1 GENERAL

.1 Refer to the schedule on the drawings.

2.2 PROPANE FIRED, CONDENSING BOILER

.1 The propane fired, condensing boiler shall be as manufactured by Viessmann, Vitodens 200-W B2HB Series. The combination of two boilers shall be capable of full modulation firing down to 10% of rated input with a turndown ratio of 10:1.

.2 Acceptable alternates subject to shop drawing review:

.1 Hydrotherm

.2 Lochinvar

.3 General

.1 The gas-fired hot water condensing heating boiler shall be fabricated of high-quality stainless steel (SA240-316Ti), featuring the latest innovations of condensing boiler technology. The boiler shall incorporate a modulating compact cylindrical stainless steel gas burner with a high-alloy stainless steel heat exchanger surface capable of operating with consistently high efficiency. The boiler control system shall maintain optimized combustion, even in case of fluctuating gas composition and air resistance. The boiler control shall have priority for both electrical and fuel savings with its intelligent combustion controller. Boiler shall be equipped with a variable speed combustion fan for quiet and economical operation.

.4 Construction

.1 The boiler shall include a single compact heat exchanger made of high-alloy stainless steel, designed based on the laminar heat transfer principle for high operational reliability and a long service life. A radial design shall be used to obtain maximum heat transfer performance in a single pass. Rectangular design of the coil is required to maximize the coil gap length and ensure maximum utilization of the heat exchanger surface. Defined gaps (0.8 mm) between coil passes sized to promote laminar flue gas flow for efficient heat transfer. The heat exchanger design shall allow for self-cleaning functionality.

.2 The burner shall be constructed from high-grade stainless steel for universal use with natural gas or propane gas. Burner ignition shall be by a direct spark ignition system. The boiler shall be equipped with a digital boiler control unit interface.

.3 The burner shall be capable of operating at altitudes of up to 10,000 ft (3,000 m) without change of orifices, but through the adjustment of a coding address.

.4 Wire and cable entry to boiler shall be facilitated by strain reliefs to protect electrical wires. All controls, relays, transformers, ignition module, wiring, and redundant seat combination gas valve shall be installed behind the boiler enclosure.

.5 The boiler shall be equipped with a coaxial vent connection, located on the top of the boiler. The boiler shall be vented using either a stainless steel, CPVC, or PP(s) venting material, certified to UL1738 or ULC S636 for use with positive pressure Category IV appliances. The boiler shall be capable of operating as a direct vent appliance (room air independent operation) using a certified coaxial or two pipe venting system, or as a single pipe appliance (room air dependant operation). The boiler shall be vented horizontally with a side wall venting system, or vertically with a chimney venting system.

.6 The boiler shall be rated for zero (0") clearance to combustibles, including its vent system.

.7 Standard equipment shall also include the following items:
- Manual reset fixed high limit set at 210°F (99°C), wired in series with ignition system
- Integrated Graphical User Interface (GUI) with digital temperature display
- 30, 45, or 60 psig pressure relief valve available
- Pressure gage and pipe fittings

.5 Certifications

.1 All individual components shall be accepted as part of the system under the governing body having jurisdiction. Field approval shall not be required for any component. Boiler shall be CSA approved and shall be built in compliance with ASME Section IV, carrying the "H" stamp.

.2 The boiler shall have the following approvals and listings, or be in compliance with: CSA, CRN, ASME, MA State approval, AHRI (GAMA), Energy Star

.6 Controls

.1 General

.1 The Vitotronic 300-K,MW2C cascade boiler control system is a communication gateway that allows for data transfer between the Viessmann LON System, used with Viessmann equipment, and a Building Management System or Building Automation System using either BACnet or Modbus communication protocols. The Vitotronic 300-K,MW2C shall offer a combination of both readable and readable/writable points available from the Viessmann equipment within the system.

.2 The Vitotronic 300-K,MW2C shall be capable of communicating with up to 1 Viessmann cascade control, and up to 8 boilers within a single system. The system shall be capable of communicating with up to 4 Viessmann systems. The Vitotronic 300-K,MW2C shall be offered in 2 versions, one version complete with an enclosure for remote mounting applications, the other as a DIN rail mountable version for installation into select equipment junction boxes.

.2 General Requirements

.1 The gateway shall have the following features:

.2 Communication with up to 1 cascade control and 8 boilers in a single system.

.3 Enclosure for remote mounting or wall mounting.

.4 Shipped complete with 24VDC Power Supply Unit.

.5 USB configuration back-up port.

.6 LAN connection port for communication with PC/Laptop, BACnet IP, or Modbus TC/IP

.7 The gateway shall be factory tested and approved by CSA as part of a package with the compatible series of boilers.

.3 Construction

.1 Control Interface

.1 The control interface shall be web browser driven, capable of displaying both metric and imperial units, and shall have a language selection menu. Menu driven selection functions, providing access to (but are not limited to) the following operating points:

.2 Able to display all system temperatures and set points.

.3 Displays unique fault message during an alarm.

.4 A program selection mode.

.5 Operating status check.

.6 Slope and shift adjustment for heating curve.

.4 Certifications

.1 All individual components shall be accepted as part of the system under the governing body having jurisdiction. Field approval shall not be required for any component.

.2 All electrical wiring is to be done in accordance with the latest editions of:

.3 CSA C22.1 Canadian Electrical Code and/or local electrical codes for Canada.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Install to NFPA 54.

.3 Install boiler wall mounted.

.4 Provide connection of propane service to NFPA 54 (AGA Z223.1).

.5 Provide piping connections and accessories as indicated.

.6 Pipe relief valves to nearest floor drain.

.7 Install circulator and diaphragm expansion tank on boiler.

.8 Provide for connection to electrical service.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Unit heaters

1.3 SUBMITTALS

.1 Product Data: Provide typical catalogue of information including arrangements.

.2 Shop Drawings:

.1 Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.

.2 Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

.3 Indicate mechanical and electrical service locations and requirements.

.3 Samples: Submit one sample of each radiation cabinet detailed.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2 Products

2.1 UNIT HEATERS (UH)

.1 Manufacturer: Reznor

.2 Other acceptable manufacturers, subject to shop drawing review;

.1 Rosemex

.2 Trane

.3 Stirling

.4 Rittling

.5 Engineered Air Model H

.3 Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

.4 Casing: 1.2mm steel with threaded pipe connections for hanger rods.

.5 Finish: Factory applied baked primer coat.

.6 Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

.7 Air Outlet: Adjustable pattern diffuser on projection models and two way louvres on horizontal throw models.

.8 Motor: permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.

.9 Control: Local multi-speed disconnect switch.

.10 Capacity: As scheduled, based on 18C (65F) entering air temperature, 60C (140F) entering water temperature.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

.3 Protection: Provide finished cabinet units with protective covers during balance of construction.

.4 Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

.5 Hydronic Units: Provide with shut-off valve on supply and lock shield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For cabinet unit heaters, fan coil units, and unit heaters, provide float operated automatic air vents with stop valve.

.6 Install electric heating equipment including devices provided by manufacturer but not factory mounted. Provide copy of manufacturer's wiring diagram submittal. Install electrical wiring to manufacturer's submittals and Division 26.

3.2 CLEANING

.1 After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

.2 Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer (VOC content not to exceed 250g/L).

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Hydronic Duct heating Coils

.2 Electric Duct Heaters

1.3 REFERENCES

.1 ARI 410 - Forced-Circulation Air-Cooling and Air- Heating Coils.

.2 SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

.3 CAN/CSA-C22.1, Ontario Electrical Safety Code.

.4 CAN/CSA-C22.2 No. 46-13, Electric Air-Heaters.

1.4 SUBMITTALS

.1 Product Data: Provide coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

.2 Shop Drawings: Indicate coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Section 23 01 00: Transport, handle, store, and protect products.

.2 Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.

.3 Protect coils from entry of dirt and debris with pipe caps or plugs.

1.8 WARRANTY

.1 Provide five (5) year manufacturer warranty for reheat coils.

2 Products

2.1 HYDRONIC DUCT HEATING COILS [DH-1] AND [DH-2]

.1 Manufacturer: Greenheck.

.2 Other acceptable manufacturers offering equivalent products, subject to shop drawing review

.1 Rosemex WBH

.2 Engineered Air

.3 Aerofin

.4 Trane

.3 Tubes: 5/8" (16mm) OD seamless copper or brass arranged in parallel or staggered pattern, expanded into fins, silver brazed joints.

.4 Fins: Aluminum or copper.

.5 Casing: Die formed channel frame of 3/64" (1.3mm) galvanized steel with 3/8" (9.5mm) mounting holes on 3" (75mm) centres. Provide tube supports for coils longer than 36" (900mm).

.6 Headers: Cast iron with tubes expanded into header.

.7 Testing: Air test under water to 1380kPa for working pressure of 1380kPa and 104°C (220°F.).

.8 Configuration: Drainable, with threaded plugs in headers for drain and vent.

.9 Fin Spacing: 1/8" (3.1mm) on centre.

2.2 ELECTRIC DUCT HEATERS

.1 Manufacturer: Neptronic. Alternate manufacturers shall be subject to shop drawing review.

.2 Supply as described below and/or on the drawings, CSA approved electric heaters according to CSA standard C22.2 No. 155 and UL 1996,as manufactured by Neptronic.

.3 Mechanical Construction

.1 Neptronic electric heaters shall be manufactured using galvanized steel of appropriate gauge and shall provide proper rigidity and resistance to corrosion.

.2 Electric heaters shall be manufactured and approved for zero clearance for all combustible materials.

.3 Provide round collars where specified on drawings.

.4 Heating Elements (Open Coil)

.1 Heating elements shall be manufactured from a grade A nickel chrome alloy (NiCr80), no traces of iron.

.5 Electrical Construction

.1 Electric heaters shall be supplied with a control panel with electric components adapted to the required voltage and current of the system.

.2 The control panel shall be manufactured for indoor conditions and shall provide safety features against accidental contact with internal components (Nema type 1) (IP10).

.3 The control panel shall include a removable, hinged door to provide easy access.

.4 The connection terminals shall be clearly identified, and a corresponding wiring diagram shall be affixed to the control panel.

.5 The following components shall be installed:

.1 Transformer with secondary fuse

.2 Magnetic contactor

.3 Automatic thermal cutout

.4 Manual thermal cutout

.5 Airflow switch

.6 Safety

.1 Electric heaters shall be supplied with the appropriate thermal cutout to protect the installations and the users against the risk of overheating.

.2 Inspections and tests shall be performed before delivery according to safety and quality standards.

.3 Protective screens shall be installed.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturers written instructions.

.2 Install in ducts and casings to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.1 Support coil sections independent of piping on steel channel or double angle frames and secure to casings.

.2 Provide frames for maximum three coil sections.

.3 Arrange supports to avoid piercing drain pans.

.4 Provide airtight seal between coil and duct or casing.

.5 Refer to Section 23 81 00.

.3 Protect coils to prevent damage to fins and flanges. Comb out bent fins.

.4 Install coils level. Install cleanable tube coils with 1:50 pitch.

.5 Make connections to coils with unions and flanges.

.6 Hydronic Coils:

.1 Hydronic Coils: Connect water supply to leaving air side of coil (counter-flow arrangement).

.2 Provide shut-off valve on supply line and lock-shield balancing valve with memory stop on return line.

.3 Locate water supply at bottom of supply header and return water connection at top.

.4 Provide manual air vents at high points complete with stop valve.

.5 Ensure water coils are drainable and provide drain connection at low points.

.6 Refer to Section 23 50 00.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 REFERENCES

.1 ASHRAE HANDBOOK, HVAC SYSTEMS & EQUIPMENT, Duct Construction Recommendations

.2 Sheet Metal And Air Conditioning Contractors' National Association (SMACNA)

.1 HVAC Duct Construction Standards - Metal and Flexible

.2 HVAC Duct Systems Design

.3 Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems

.4 Accepted Industry Practice for Industrial Duct Design

.5 HVAC Systems - Testing, Adjusting and Balancing

.6 Round Industrial Duct Construction Standards

.7 Rectangular Industrial Duct Construction Standards

.8 HVAC Air Duct Leakage Test Manual.

.9 Guide for Steel Stack Construction

.3 National Fire Protection Association (NFPA)

.1 80 Standard for Fire Doors and Windows

.2 90A Standard for Installation of AC and Ventilation Systems

.3 90B Standard for Installation of Warm Air Heating and AC Systems

.4 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 255 Building Materials, Test of Burning Characteristics (same as ASTM E84)

.4 American Society for Testing and Materials (ASTM)

.1 A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.2 A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.3 A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

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

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

.6 B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

.7 A240 Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels

.8 A480 Standard Specification for General Requirements for Flat Rolled Stainless Heat-Resisting Steel Plate, Sheet and Strip

.9 A653 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated by the Hot Dip Process .

.10 E84 Standard Test Method for Surface Burning Characteristics of Building Materials .

.11 E477 Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Material and Prefabricated Silencers .

.12 E814 Standard Test Method for Fire Tests of Through Penetration Fire Stops

.5 American Welding Society (AWS)

.1 B2.2 Brazing Procedures and Performance Qualifications

.2 D9.1 Sheet Metal Welding Code

.6 Underwriter's Laboratories (UL)

.1 181 Factory Made Air Ducts and Air Connectors

.2 555 Standard for Safety Fire Dampers

.3 555S Leakage Rated Dampers for Use in Smoke Control Systems

.4 723 Test for Surface Burning Characteristics of Burning Materials (ASTM E84)

1.3 PERFORMANCE REQUIREMENTS

.1 No variation of duct configuration or sizes permitted except by written permission.

.2 Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

.3 Sizes indicated on drawings are clear inside dimensions and do not include for duct linings.

1.4 SUBMITTALS

.1 Shop drawings and product Data: data for duct materials.

.2 Shop Drawings:

.1 Plenums and plenum related items showing physical dimensions, joints, sealants, door construction and hardware.

.2 Factory fabricated ducts, fittings and joining systems.

.3 Firewall duct penetrations; fire and smoke dampers; louvers and access doors.

.4 Duct fitting particulars such as gauges, sizes, welds, reinforcements and configuration for 4"wg. (1000kPa) pressure class and higher systems.

.3 Submit changes or alterations in ductwork layout, with supporting calculations showing that the modified design will not increase total pressure, before work commences. Submittals for proposed changes shall be stamped for acceptance prior to commencement of work.

.4 Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

.5 Material Safety Data Sheets (MSDS) for sealants, adhesives and coatings.

.6 Manufacturer's Installation Instructions: Indicate special procedures for glass fibre ducts.

.7 Submit two samples of typical shop fabricated duct fittings.

1.5 PROJECT RECORD DOCUMENTS

.1 Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

.1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible. .

.2 Perform Duct Leakage Testing to SMACNA "HVAC Air Duct Leakage Testing Manual"

.3 Maintain one copy of document on site.

.4 Asbestos Free: Insulating and sealing materials must be certified to be free of asbestos.

.5 Brazing: Certify brazing procedures, brazers, and operators in accordance with AWS B2.2 Brazing Procedures and Performance Qualifications

.6 Welding: Certify welding procedures, welding equipment and welders in accordance with AWS D9.1 Sheet Metal Welding Code.

1.7 REGULATORY REQUIREMENTS

.1 Ontario Building Code (OBC)

.2 Ontario Fire Code (OFC)

.3 Construct ductwork to NFPA 90A standards.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

.2 Maintain temperatures during and after installation of duct sealants.

2 Products

2.1 MATERIALS

.1 Table of materials:

Application	Materials
Rigid HVAC ducts, casings and fittings	ASTM A653 galvanized steel sheet, lock form quality, G90 zinc coating (0.90 oz/ft2) to ASTM A90. Sheets free of pits, blisters, slivers, and ungalvanized spots.
Breeching and chimneys	Black steel to ASTM A621 Specification for Steel Sheet and Strip Carbon Hot Rolled Drawing Quality. Al l seams and joints continuously welded.

.2 Hanger Rod: continuously threaded, ASTM A36 galvanized steel in general, stainless steel for stainless steel ducts.

.3 Sealant: Non-hardening, water resistant, fire resistive, low VOC (VOC content not to exceed 250g/L), compatible with mating materials; liquid used alone or with tape, or heavy mastic.

.4 Supports: Angle iron, channels, rods and related supporting materials shall be galvanized or red oxide coated.

.5 Fasteners: Use galvanized rivets, screws and bolts throughout, except on stainless steel ductwork, use SS fasteners.

.6 Reinforcements: Provide galvanized steel or stainless steel reinforcement shapes and plates to match ductwork.

.7 Tie Rods: Use galvanized steel, 1/4" minimum diameter fasteners for ductwork 36” (900mm) or less in length; use 3/8” minimum diameter for lengths longer than 36” (900mm).

.8 Thickness, fabrication and reinforcement to SMACNA.

2.2 DUCT CONSTRUCTION

.1 Duct construction schedule:

Duct Application	Duct Pressure	Pressure Class (ins. wg.)	Seal Class	Leakage Class
Rectangular HVAC single zone supply from HRV unit to air outlet	Positive	2	A	6
Round HVAC single zone supply from HRV unit to air outlet	Positive	2	A	3
Rectangular HVAC return from air inlet to HRV	Negative	2	A	6
Round HVAC return from air inlet to HRV	Negative	2	A	3
Rectangular sanitary exhaust ductwork	Negative	2	A	6
Round sanitary exhaust ductwork	Negative	2	A	3
Rectangular general HVAC exhaust	Negative	2	A	6
Round general HVAC exhaust	Negative	2	A	3
HRV Unit discharge ductwork	Positive	2	A	0

.2 Note:

.1 Pressure class shall be the lower of the exhaust fan shut-off pressure or value shown.

2.3 DUCT SEALING

.1 Duct sealing schedule:

Seal Class	Sealing Requirements
A	All transverse joints, longitudinal seams and duct wall penetrations.
B	All transverse joints and longitudinal seams.
C	All transverse joints.

2.4 DUCT LEAKAGE

.1 Leakage Class is defined as

$CL = F / (P)^{0.65}$

where: CL = Leakage Class

F = Leakage Factor (cfm/100sq.ft. of duct surface)

P = Static pressure in the duct (in.wg.)

.2 Table

Leakage Factor (F) CFM/100sq.ft. of duct surface					
Leakage Class	Pressure Class (ins.wg.) Positive or Negative				
C_L	1	2	4	6	10
48	48	75	118	154	214
24	24	38	59	77	107
12	12	19	30	38	54
6	6	9	15	19	27
3	3	5	7	10	13
0	0	0	0	0	0

2.5 DUCTWORK FABRICATION

.1 All Ductwork shall be constructed to withstand 1-1/2 times fan pressure at shut-off and 2" (500Pa) minimum.

.2 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated in accordance with recommendations of ASHRAE and SMACNA.

.3 Joints and reinforcements:

.1 to SMACNA and ASHRAE

.2 may be made with the Ductmate System or Nexus System. System components shall be made of standard catalogue manufacture as supplied by Ductmate Industries, Inc. Or Nexus Inc.

.4 Construct Tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fibre insulation.

.5 Increase duct sizes gradually, not exceeding 15deg. divergence wherever possible; maximum 30deg. divergence upstream of equipment and 45deg. convergence downstream.

.6 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 4” (100mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

.7 Provide standard 45-degree lateral wye takeoffs. Alternative 90deg. conical tee connections may be used only where specifically indicated.

2.6 ROUND SPIRAL LOCK SEAM DUCTWORK

.1 Spiral ducts and elbows shall not be used for watertight exhaust systems.

.2 Ducts and fittings shall be manufactured from minimum G90 galvanized steel meeting ASTM A527/A527M-85.

.3 Ductwork shall be "Uni-Seal" single wall, round spiral lock-seam type duct with wall thicknesses listed below.

.4 Fittings shall be "Uni-Form" single wall, round fittings suitable for use with "Uni-Seal" ductwork in wall thicknesses as follows:

Diameter ins. (mm)	Duct Metal Thickness ins. (Ga.) (mm)	Fitting Metal Thickness ins. (Ga.) (mm)
3-14 (75-350)	0.022 (26) (0.56)	0.028 (24) (0.70)
15-26 (375-650)	0.028 (24) (0.70)	0.034 (22) (0.86)
27-36 (675-900)	0.034 (22) (0.86)	0.040 (20) (1.00)
37-50 (925-1250)	0.040 (20) (1.00)	0.052 (18) (1.32)
52-60 (1300-1500)	0.052 (18) (1.32)	0.064 (16) (1.62)

.5 Acceptable Manufacturer: "Uni-Seal" spiral lock-seam duct and "Uni-Form" fittings as manufactured by United Sheet Metal. Other manufacturers subject to shop drawing review.

3 Execution

3.1 INSTALLATION

.1 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Install ductwork parallel to building lines.

.3 Support all ductwork from structural members. Where structural bearings do not exist, suspend strapping or hangers from steel channels or angles. Provide supplementary structural members. Do not suspend from metal deck.

.4 Do not break continuity of insulation vapour barrier by hangers or rods.

.5 Hangers shall be steel angles with supporting rods, locking nuts and washers to following table:

Duct Size ins. (mm)	Angle Size ins. (mm)	Rod Size ins. (mm)	Spacing ft. (m)
<30 (750)	1x1x1/8 (25x25x3)	1/4 (6)	10.0 (3000)
31-42 (775-1050)	1-1/2x1-1/2x1/8 (38x38x3)	1/4 (6)	10.0 (3000)
43-60 (1050-1500)	1-1/2x1-1/2x1/8 (38x38x3)	3/8 (9)	10.0 (3000)
61-84 (1525-2100)	2x2x1/8 (50x50x3)	3/8 (9)	8.0 (2400)

.6 Anchor all risers at bottom and support from building structure at each floor level.

.7 Vertical ducts passing through floors shall be supported on angles secured to duct bearing on the floor.

.8 Where ducts pass through walls, floors, openings required to have a fire resistance rating the opening in the construction around the duct shall be filled with an approved fire stop material as per NFPA 90A and fire damper shall also be installed with access doors as per the code.

.9 Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

.10 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.11 Support risers in accordance with SMACNA.

.12 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.13 Use crimp joints with or without bead for joining round duct sizes 8" (200mm) and smaller with crimp in direction of air flow.

.14 Use double nuts and lock washers on threaded rod supports.

.15 Connect terminal units to supply ducts directly or with 12" (300mm) maximum length of flexible duct. Do not use flexible duct to change direction.

.16 Ground across flexible connector with No. 2/0 braided copper strap.

.17 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.

.18 Install HTL ductwork between duct silencer and mechanical room wall.

.19 Balancing dampers shall be installed on branches as per locations shown on the drawings and as per the requirements of NEBB and AABC listing/measuring standards.

.20 Perform duct leakage testing for all ductwork installed under this contract.

.21 Paint all visible internal portions of duct outlets to grilles dull black. Internal painting of ductwork behind grilles shall be by Sheet Metal Contractor.

.22 Seams and penetrations in ductwork and plenums shall be sealed in accordance with seal classifications as described in SMACNA and ASHRAE.

.23 Do not begin air balance until system has been completed and is in full working order. Put all heating, ventilating, and air conditioning system and equipment into full operation and continue the operation of same during each working day of balancing procedures. Provide assistance to the Testing and balancing Agency as required.

3.2 WATERTIGHT DUCTWORK

.1 Sprial ducts and elbows shall not be used for watertight exhaust systems.

.2 Provide watertight ductwork for:

.1 Fresh air intake ducts and plenums

.3 Form bottom of duct without longitudinal seams.

.4 All seams and joints welded. Connections to equipment and accessories flanged and gasketed.

.5 Slope horizontal branch ductwork down toward hood or equipment served.

.6 Slope header ducts down toward risers.

.7 Fit base of risers with 6" (150mm) deep drain and 1-1/4" (32mm) drain connection, with deep seal trap and valved drain line to open funnel drain.

3.3 DUCT CLEANLINESS

.1 All ductwork shall be handled and installed in accordance with the advanced level described in SMACNA Duct Cleanliness for New Construction Guidelines.

.2 After completing system installation including outlet fittings and devices, inspect the system.

.3 Ductwork leaving the premises of the manufacturer may include some or all of the following:

.1 self-adhesive labels or marking for part(s) identification shall be applied to external surfaces only;

.2 exposed mastic sealant;

.3 light zinc oxide coating on the metal surface;

.4 a light coating of oil on machine formed ductwork;

.5 minor protrusions into the airway of rivets, screws, bolts and other jointing devices;

.6 internal insulation and associated fasteners;

.7 discoloration marks from plasma cutting process.

.8 to maintain cleanliness during transportation, all ductwork shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping. Care must be taken to prevent damage during transportation and off loading.

.4 A clean and dry environment where the ductwork is protected from dust, must be provided for the storage of ductwork prior to installation. All sealed ends shall be visually examined and if damaged resealed with an appropriate material.

.5 During installation, the working area shall be clean, dry and the ductwork protected from dust.

.6 The internal surfaces of the un-insulated ductwork shall be wiped to remove excess dust immediately prior to installation.

.7 Open ends on completed ductwork and overnight work-in-progress shall be sealed.

.8 Access covers shall be firmly fitted in position on completion of each section of the work.

.9 Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.

3.4 DUCT LEAKAGE TESTING

.1 Ductwork shall be leak tested in accordance with the SMACNA "HVAC Air Duct Leakage Test Manual". The maximum permitted duct leakage shall be determined by multiplying the leakage factor by the surface area of the ductwork in the test zone.

.2 Ductwork that exceeds the maximum permitted leakage shall be re-sealed and re-tested.

.3 Duct leakage test shall be witnessed and certified by the Systems Verification Agency.

.4 Record and submit three (3) copies of test results to the Consultant for review prior to application of duct insulation or concealment of ductwork.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Air turning devices/extractors.

.2 Back draft dampers.

.3 Duct access doors.

.4 Duct test holes.

.5 Fire dampers.

.6 Flexible duct connections.

.7 Volume control dampers.

1.3 REFERENCES

.1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

.2 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.3 UL 33 - Heat Responsive Links for Fire-Protection Service.

.4 CAN/ULC-S112 - Fire Test of Fire-Damper Assemblies.

.5 CAN/ULC-S112.2 - Fire Test of Ceiling Firestop Flap Assemblies.

1.4 SUBMITTALS

.1 Submit a ‘Letter of Conformance’, indicating the specified items selected for use in this Project with the following supporting product data reports.

.2 Shop Drawings for shop fabricated assemblies including balancing dampers, volume control dampers, duct access doors and duct test holes.

.3 Product Data for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.

.4 Manufacturer's Installation Instructions for fire dampers and combination fire and smoke dampers.

1.5 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: CSA Listed as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Transport, handle, store, and protect products.

.2 Protect dampers from damage to operating linkages and blades.

1.7 EXTRA MATERIALS

.1 Provide two of each size and type of fusible link.

2 Products

2.1 AIR TURNING DEVICES / EXTRACTORS

.1 Turning vanes in rectangular duct elbows shall be double walled, multi-blade vanes with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps. Acceptable Products: Duro-Dyne "Duro Vane Rail", Hart & Cooley "Ducturn", Dyn-Air or Tuttle and Bailey.

.2 Volume extractors: gang operated curved blades, adjustable from full open to full closed positions. Units shall be factory assembled, fabricated from 14ga. and 22ga. (2 and 0.9mm) steel, with blades on 1" (25mm) centres, and No. 2 or No. 3 operators to suit application. Acceptable Products: Krueger model EX-8 indicated. EH Price Model AE1, Duro-Dyne, Dyn-Air or Hart & Cooley.

2.2 BACK DRAFT DAMPERS

.1 Gravity back draft dampers, Size 18" x 18" (450 x 450mm) or smaller, provided with air moving equipment: Air moving equipment manufacturers standard construction.

.2 Multi-blade, parallel action gravity balanced back draft dampers: 1/16" (1.5mm) thick galvanized steel, or, with centre pivoted blades of maximum 6" (150mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 VOLUME CONTROL DAMPERS

.1 Factory fabricated with recognized hardware and accessories and to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Splitter Dampers:

.1 Material: Same gauge as duct to 24" (600mm) size in either direction, and two gauges heavier for sizes over 24" (600mm).

.2 Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.

.3 Operator: Minimum 24" (600mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.

.3 Single Leaf Dampers: fabricated from minimum 20 gauge (1.0mm) galvanized steel, suitably reinforced to prevent vibration and fitted with indicating regulator. Duro-Dyne, Lawson & Taylor, Dyn-Air.

.4 Multi-Blade Opposed Action Dampers: fabricated from 16 gauge (1.6mm) galvanized steel, mounted in separate channel frames, reinforced to prevent vibration, and fitted with opposed action linkage hardware. Duro-Dyne "Opax" blade kit, Lawson & Taylor, Dyn-Air.

.5 End Bearings: Except in round ductwork 12" (300mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

.6 Quadrants:

.1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.

.2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

.3 Where rod lengths exceed 30" (750mm) provide regulator at both ends.

2.4 FIRE DAMPERS

.1 Manufacturers:

.1 Ruskin

.2 Controlled Air

.3 Nailor

.4 Others: Subject to shop drawing review.

.2 Fire dampers shall be ULC listed, labelled, or Warnock-Hersey label, meet all requirements of NFPA 90A, and constructed and rated in conformance with:

.1 CAN/ULC-S112, "Fire Test of Fire-Damper Assemblies", when used in a fire separation of not more than 3 hours.

.2 CAN/ULC-S112.2, "Fire Test of Ceiling Firestop Flap Assemblies", when used in a ceiling fire separation.

.3 Fire dampers shall be galvanized steel channel frame curtain type galvanized steel interlocking blades, minimum 22 gauge (0.9mm) galvanized steel enclosure, and 160F (71C) fusible link standard.

.4 Fire dampers for horizontal installation in vertical ductwork shall be operated by a stainless steel closure spring and latch.

.5 Fire damper configuration shall be low resistance type B with blades located outside of the air stream for rectangular ductwork, and type C for round or oval ductwork.

.6 Ceiling fire dampers shall be ULC labelled, for fire rated membrane type ceilings, galvanized steel construction with heat retardant blanket (non-asbestos) with standard 160F (71C) fusible link.

.7 Thermal blanket shall be ULC labelled, for fire rated membrane type ceilings, to completely enshroud ceiling penetration.

.8 Fire dampers in stainless steel ductwork shall be of all stainless steel construction.

.9 Fusible Links: UL 33, separate at 160F (71C) with adjustable link straps for combination fire/balancing dampers.

.10 Fire dampers listed for static systems shall be provided in ductwork where no air flow through the damper is expected such as in ductwork in HVAC systems that are automatically shut down in the event of a fire or for air transfer openings in walls or partitions.

.11 Fire dampers listed for dynamic systems shall be provided in ductwork where the airflow is operational at the time of fire, such as in smoke control systems, or from other situations in which the fan system is operational at the time of a fire.

2.5 DUCT ACCESS DOORS

.1 Fabricate doors airtight and suitable for duct pressure and to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. .2 Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated duct work, install minimum 1" (25mm) thick insulation with sheet metal cover. .1 Less Than 12" (300mm) Square: Secure with sash locks. .2 Up to 18" (450mm) Square: Provide two hinges and two sash locks. .3 Up to 24" x 48" (600 x 1200mm): Three hinges and two compression latches with outside and inside handles. .4 Larger Sizes: Provide an additional hinge. .3 Access doors with sheet metal screw fasteners are not acceptable.

2.6 DUCT TEST HOLES

.1 Provide test ports to suit intended application, (ie. Insulated / un-insulated duct, round/rectangular duct). .2 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps. .3 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation. .4 Acceptable Products: Air Power Co. Dial 1000, Dial 2000 or Duro-Dyne IP-1, IP-2, IPG-3, IP-4, Dyne-Air.

2.7 FLEXIBLE DUCT CONNECTORS

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. .2 Connector: Fabric crimped into metal edging strip. .1 Fabric: UL listed fire-retardant neoprene

coated woven glass fibre fabric to NFPA 90A, minimum density 1.0kg/sq m. .2 Net Fabric Width: Approximately 2" (50mm) wide. .3 Metal: 3" (75mm) wide, 1/32" (0.6mm) thick.

2.8 HANGERS AND SUPPORTS

.1 Fabricate strap hangers to same material as duct. Hanger configuration to SMACNA details. 20" (500mm) is maximum duct size to be supported by strap hanger. .2 Rod and angle hangers: galvanized steel to SMACNA details. .3 Hanger attachments: manufactured concrete inserts, expansion shields and bolted steel clamps. Do not weld rods to steel decks or use powder actuated fasteners.

2.9 DUCT LINING

.1 Fibre free duct lining.

2.10 DUCT SEALANT

.1 General: Low VOC, water based sealant, non-toxic, non-combustible, non-flammable, and tested in accordance with CAN4-S102-M83. Flame spread shall not exceed 25 and smoke developed shall not exceed 50.

.2 Acceptable Products: Multi-Purpose Duct Sealant as manufactured by Trans Continental Equipment, Duro Dyne SWB Duct Sealer, Iron Grip 601 as supplied by Alpha Sheet Metal Co., or Uni-Grip Duct Sealer from United McGill Corporation.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

.1 Install accessories to manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15810 for duct construction and pressure class.

.2 Provide back draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

.3 Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8" x 8" (200 x 200mm) size for hand access, 18" x 18" (450 x 450mm) size for shoulder access, and as indicated. Provide 4" x 4" (100 x 100mm) for balancing dampers only. Review locations prior to fabrication.

.4 Provide duct test holes where indicated and required for testing and balancing purposes.

.5 Provide fire dampers , combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components , and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

.6 Install smoke dampers and combination smoke and fire dampers to NFPA 92A.

.7 Demonstrate re-setting of fire dampers to Owner's representative.

.8 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. For fans developing static pressures of 1250Pa and over, cover connections with loaded vinyl sheet, held in place with metal straps.

.9 Use splitter dampers only where indicated.

.10 Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

.11 Provide turning vanes where space restrictions prohibit the use of elbows having a minimum inside radius equal to the duct width for horizontal elbows or the duct depth for vertical elbows.

.12 Provide test ports as required by Balancing Agency and at inlet and outlet of fans, to completely test and balance the system. No temporary holes will be permitted in ductwork or flexible connections.

3.3 FIRE DAMPERS

.1 Provide fire dampers where shown on drawings. In general, fire dampers are required where ducts pass through fire rated assemblies, floors and roofs and ducts entering and leaving duct shafts and mechanical rooms.

.2 Install fire dampers in strict accordance with manufacturer's installation instructions and in conformance with NFPA 90A.

.3 Install type A fire dampers anywhere there are extreme space limitations and then only where dimension of duct exceeds 12" (300mm) in direction of blade closing, and is specifically approved by Consultant.

.4 Install type B fire dampers for rectangular ductwork.

.5 Openings for fire dampers must be properly prepared and the fire dampers installed, and secured prior to field review by the Consultant. Notify the Consultant when ready for review. Do not make any duct connections to fire dampers until review is complete and work found correct.

.6 Support fire dampers from building structure. Submit erection drawings, approved by all authorities, showing the locations and construction details of all fire dampers before proceeding with any work.

.7 Install ceiling fire dampers where ducts serve grilles and diffusers in rated ceilings. Support from building structure.

.8 Install thermal blanket in all fire rated membrane type ceilings. Thermal blanket shall be wrapped and stapled around the unexposed perimeter of diffuser after installation of ceiling damper following manufacturer's installation instructions.

3.4 DUCT ACCESS DOORS

.1 Provide duct access doors of suitable size in ductwork in the following locations:

.1 Suction inlet of all fans

.2 At not more than 12m intervals

.3 At not more than 6m intervals on the ductwork installed after a high efficiency filter

.4 At the base of all main risers

.5 In front of and behind all turning vanes and coils

.6 At all fire, smoke, and motorized dampers

.7 At all locations having an internally mounted piece of equipment or device. Provide a section of transparent plexi-glass to permit viewing without opening the access doors

.8 Where required for duct cleaning.

.2 Wherever possible, doors shall be mounted to close in direction of air flow.

3.5 DUCT LINING

.1 Line internal surfaces of all ductwork, shown cross hatched on drawings with 1" (25mm) thick duct lining. Butt joints tightly together.

.2 Adhere lining to all sides of duct with minimum 50% coverage of flame resistant adhesive. Impale lining over welded pins on 12" (300mm) centres at top sections and sides and secure with speed washers.

.3 Repair damage to neoprene compound coating on duct liner incurred during installation by spraying or brush coating with approved similar compound.

.4 No allowance has been made in duct sizes indicated for internal lining. Increase duct size 1" (25mm) all around where lining is to be internally applied.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.2 SECTION INCLUDES

.1 Heat recovery ventilators.

1.3 REFERENCES

.1 AMCA 99 - Standards Handbook.

.2 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal.

.4 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

.5 AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

1.4 SUBMITTALS

.1 Provide shop drawings and product data on fans and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements.

.2 Manufacturer's Installation Instructions.

1.5 EXTRA MATERIAL

.1 Provide two sets of belts for each fan.

2 Products

2.1 HEAT RECOVERY VENTILATORS

.1 Manufacturers: Vanee indicated or equivalent products subject to shop drawing review.

.2 Product Requirements:

.1 Comply with UL 1812 requirements regulating the installation of Heat Recovery Ventilators.

.2 Comply with the CSA C22.2 no. 113 Standard applicable to ventilators.

.3 Comply with CSA C444 requirements regulating the installation of Heat Recovery Ventilators.

.4 HVI certified and ENERGY STAR® qualified.

.3 Performance: as scheduled on drawings.

.4 Ventilator Unit: Direct driven, powder coated steel housing with expanded polystyrene insulation, two backward inclined impellers/blowers mounted on a single shaft to a common motor, polypropylene cross-flow enthalpy core, washable intake and exhaust core filters, balancing dampers, and condensate drain.

.5 Electrical Characteristics and Components

.1 Electrical Characteristics: as scheduled

.2 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

.3 Disconnect: Factory wired, non-fusible, in housing for thermal overload protected motor.

3 Execution

3.1 INSTALLATION

.1 Install HRV units in accordance with manufacturer's instructions.

.2 Provide flexible duct connections between each fan and ductwork. Ensure metal bands of connectors are parallel with minimum 1" (25mm) flex between ductwork and fan while running.

.3 Provide sheaves as required for final air balance.

.4 Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

.5 HRV Units: support the units independently of ductwork.

.6 Install fan speed controller at location shown on drawing and provide control wiring.

.7 Electrical trade shall provide dry contacts for occupancy sensors and wiring for control of heat recovery ventilators based on 30-min. time delay for operation of ventilators.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.1 SECTION INCLUDES

.1 Crosslinked polyethylene tubing and fittings

.2 Distribution manifolds

.3 Manifold cabinets

.4 Accessories

1.2 REFERENCES

.1 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials

.2 ASTM F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing

.3 ASTM F877, Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems

.4 ASTM F2080, Standard Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe

.5 CSA B137.5, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications

.6 CSA B214, Installation Code for Hydronic Heating Systems

.7 DIN 4726, Plastic Piping Used in Warm Water Floor Heating (Warmwasser-Fußbodenheizungen und Heizkörperanbindungen - Rohrleitungen aus Kunststoffen

.8 ISO 9001, Quality Management Systems – Requirements

.9 CAN/ULC S102.2, Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials

.10 PPI TR-3, Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

1.3 DEFINITIONS

.1 Crosslinked polyethylene, or PEX is a modified polyethylene material, typically high-density polyethylene (HDPE), which has undergone a change in the molecular structure using a chemical or a physical process whereby the polymer chains are permanently linked to each other. This crosslinking of the polymer chains results in improved performance properties such as elevated temperature strength, chemical resistance, environmental stress crack resistance (ESCR), resistance to slow crack growth (SCG), toughness, and abrasion resistance. Crosslinking also makes PEX a “semi-thermoset” polymer, providing excellent long-term stability

1.4 QUALITY ASSURANCE

.1 Pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.

.2 Crosslinked polyethylene (PEXa) pipe shall conform and be certified to ASTM F876 and CSA B137.5, and shall have the PPI TR-3 listing. Pipes with an oxygen diffusion barrier shall conform to the requirements for oxygen permeability DIN 4726.

1.5 QUALIFICATIONS

.1 Manufacturer: Must be a company specializing in the Work of this Section with a minimum of ten (10) years documented experience.

.2 Installation shall be performed by qualified installers trained by the manufacturer in the procedures required for the radiant heating and/or cooling systems and appropriately licensed for the jurisdiction where the installation will take place.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store piping and equipment in shipping containers with labeling in place.

.1 Pipe shall be kept in original packaging until required for installation.

.2 Store piping and equipment in a safe place, dry, enclosed, under cover, in a well-ventilated area.

.1 Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.

.2 Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.

.3 Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants and cross-connections.

.4 Piping shall not be dragged across the ground or other surfaces, and shall be stored on a flat surface with no sharp edges.

.3 Protect materials from damage by other trades.

.4 Pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

1.7 SUBMITTALS

.1 Product Data: Submit manufacturer's Technical Manual, submittal forms, catalog cuts, brochures, specifications, and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.

.1 Submit manufacturer's instructions for installation.

.2 Submit data for equipment, fittings, fasteners and associated items necessary for the installation of the piping and manifolds.

.2 Submit computer-generated system design indicating pipe sizing, spacing, flow rates and temperatures. Design calculations shall be performed on pipe manufacturer's software or equivalent.

.3 Drawings: Provide plans drawn to scale for all installation areas.

.1 Indicate dimensions, descriptions of materials, general construction, component connections, anchorage methods and installation procedures.

.2 Indicate design, schematic layout of system, including equipment, critical dimensions and piping/slab penetration details as well as details for protecting exposed PEX piping.

.4 Certification

.1 Submit third-party certification results for the piping systems from an accredited testing laboratory.

.2 The design shall be approved by a professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.

.3 Fittings shall be third-party certified to applicable referenced standards with independent listings from NSF and/or CSA, as applicable.

.5 Copy of the certificate indicating that the installer is certified in the installation of the manufacturer’s products.

.6 Maintenance Instructions: Submit product instructions for any maintenance required or recommended by manufacturer.

.7 Final “As-Built” loop layout drawing(s).

1.8 WARRANTY

.1 Provide a twenty-five (25) year manufacturer standard written warranty for the crosslinked polyethylene pipe.

.2 Provide a five (5) year non-prorated warranty for manifolds and fittings.

2 Products

2.1 GENERAL

.1 Manufacturer: Rehau Industries Inc., products indicated or equivalent by:

.1 Watts Radiant

.2 Uponor

2.2 TUBING

.1 All radiant heating and/or cooling pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (PEXa). Pipe shall conform to ASTM F876 and CSA B137.5.

.2 Pipe shall be rated for 690kPa (100psi) gauge pressure at 82C (180F) temperature), and 550kPa (80psi) gauge pressure at 93C (200F) temperature.

.3 Pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.32 mg/(m2*d) @ 40°C (104°F) temperature, in accordance with DIN 4726.

.4 Bend Radius

.1 The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter.

.2 Bends with a radius less than this shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.

.5 Compliant to the following standards:

.1 ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).

.2 UL Design No. L588- 1 hour wood frame floor/ceiling assemblies

.3 UL Design No. K917 - 2 hour concrete floor/ceiling assemblies

.4 UL Design No. U383 - 1 hour wood stud/gypsum wallboard wall assemblies

.5 UL Design No. V461 - 1 hour steel stud/gypsum wallboard wall assemblies

.6 Pipe to have a Flame Spread Index and a Smoke Developed Index listing to ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada). This listing may require the pipe to be installed in a rated insulation material or an approved steel support channel.

2.3 FITTINGS

.1 Fittings shall be third-party certified to applicable standards ASTM F877, ASTM F2080 and CSA B137.5, with independent listings from NSF and/or CSA as applicable.

.2 Compression nut manifold fittings shall be manufactured of brass with a barbed insert and a split compression ring.

.3 Compression-sleeve fittings shall be manufactured of brass and shall be approved by the piping manufacturer to be part of a proven cataloged system.

.4 Fittings embedded within the thermal mass or encased behind walls or ceilings shall be cold-expansion compression-sleeve fittings certified to ASTM F2080. Where required by the manufacturer, fittings shall be protected from external environmental conditions.

2.4 MANIFOLDS

.1 Material: Distribution manifolds shall be manufactured of stainless steel and be supplied by the piping manufacturer as a proven cataloged part of the manufacturer's system.

.2 Each manifold shall be complete with:

.1 Visual flow gauges for each circuit on supply side

.2 Circuit balancing/isolation valves on return side

.3 Two 1 in. NPT supply and return manifold isolation valves with thermometer housings;

.4 Two mini thermometers

.5 Two air vent/boiler drain valves with manual air vent and 3/4 in. hose connection

.6 Manifold circuit chart

.7 Vent key and key holder

.8 Product instructions

.9 24 VAC Valve actuators for each circuit

.3 100% of manifolds used shall have been air tested by the manufacturer with no indication of leaks.

2.5 MANIFOLD CABINETS

.1 Provide either surface mounted or recessed manifold cabinets, as indicated on the drawings, of sufficient size to allow sufficient space for pump, mixing valve, isolation valves, circuit setting valves, control wiring and circuit zone valves to be installed within the cabinet. Minimum size of cabinets to be 600mm x 695mm x 110mm (23-5/8” x 27-3/8” x 4-5/16”). Piping and components to be installed in cabinets in the factory. Coordinate control and power requirements with Division 26.

2.6 ACCESSORIES

.1 Provide four (4) actuator controllers, one for each manifold. This controller shall have built-in transformer and provide 24VAC to control zone thermostats and actuator valves.

.2 Provide two-stage programmable thermostats, flush mount indoor sensors and floor sensors as shown on drawings.

3 Execution

3.1 EXAMINATION

.1 Examine areas and conditions under which work of this Section shall be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

.2 Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

.1 Coordinate with related trades and manufacturer's recommendations with regard to installation in conjunction with:

.1 Reinforcing wire mesh or rebar.

.2 Preparation of space for manifold installation.

.2 Prepare the installation site as appropriate:

.1 For Concrete Slab-on-Grade: Sub-grade should be compacted, flat and smooth to prevent damage to pipe or insulation. Approved vapor barrier material should be installed. Approved thermal insulation, according to the design, shall be installed. Reinforcing wire mesh, if required by structural design, must be flat and level, with all sharp ends pointing down. Finished grade of the thermal mass must be a minimum of 51mm (2”) above the top of PEX heating and/or cooling pipes.

.2 For Non-Structural Over pour on Sub-floor: Sub-floor must be structurally sound, clean and free from all construction debris which could potentially damage the pipe. Replace any areas that appear weak. To facilitate installation of pipe, remove all unnecessary stud wall baseplates in doorways and other areas. Treat any wood sub-floors with a sealant in accordance with the specifications set forth by the screed installation section, or use pressure-treated wood, as per local code requirements. Finished grade of the thermal mass over pour must be a minimum of 19mm (3/4”) above the top of PEX heating and/or cooling pipes.

.3 For Structural Concrete Sub-floor: Sub-floor must be clean and free from all construction debris which could potentially damage the pipe. Finished grade of the concrete thermal mass must be a minimum of 51mm (2”) above the top of PEX heating and/or cooling pipes.

.3 Preparation of wall cavity for manifold installation: See drawings to determine the width of the wall cabinet (if required) and required wall opening dimensions. Mount the manifold cabinet allowing space for the screed to fill up the front of the pipe opening. If a cabinet is not used, prepare a suitable cavity for the manifold, with a secure mounting plate that will secure the manifold at least 750mm (30”) above floor level. Manifold must be installed in an area that will allow easy access for supply/return piping as well as future access maintenance.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's published installation manual and/or published guidelines and final drawings.

.2 Mount manifolds in the locations previously prepared or in previously installed cabinets, if used. Manifolds shall be mounted as level as possible.

.3 Route piping in an orderly manner, according to layout and spacing shown in final drawings. All installation notes shown on the drawings shall be followed.

.4 At connections and fittings, use a plastic pipe cutter to ensure square and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants. No fittings shall be permitted within the thermal mass

.5 Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane. Finished grade of a structural slab shall be a minimum of 51mm (2”) above the top of PEX heating and/or cooling pipes. Fasten piping at no more than 900mm (36”) intervals, being careful not to twist the pipe. In non-structural concrete slabs, the finished grade of the thermal mass shall be a minimum of 19mm (3/4”) above the top of the PEX and the piping shall be secured every 600mm (24”). Use only fasteners supplied or approved by the manufacturer of the PEX pipe.

.6 Piping that passes through expansion joints shall be covered in protective polyethylene corrugated sleeving (flexible conduit) extending 380mm (15”) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation of thermal mass.

.7 Where piping exits the thermal mass, a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 150mm (6”) into the floor and exiting by a minimum of 150mm (6”). For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.

.8 At the time of installation of each circuit of pipe, connect the pipe to the correct manifold outlet and record pipe length for balancing. If manifold is not installed, cap the end of the pipe and label the pipe's circuit numbers along with “S” for supply and “R” for return. Connect pipes to manifold

as soon as possible and record circuit lengths. All circuits shall be labeled to indicate circuit length and serviced area.

.9 The following precautions shall be taken in areas intended for carpet:

.1 Keep pipes 150mm (6”) from all wall baseplates.

.2 Install metal guards where pipe will pass through wall baseplates and where carpet tack strips will be installed.

.10 The following precautions shall be taken in areas intended for hardwood flooring:

.1 Ensure that nailing areas for hardwood flooring, if nailing is required, are clearly marked and known for hardwood installers.

.11 If the radiant heating and/or cooling system substrate material (thermal mass) requires curing and/or has other limitations which can be influenced by the radiant heating and/or cooling system while in operation, then the radiant heating and/or cooling system shall not be put into operation until such time that the substrate material has fully cured or set according to the material requirements of the substrate manufacturer.

.12 The installer shall confirm minimum and maximum exposure temperatures for the substrate material (thermal mass) and shall ensure proper radiant heating and/or cooling operating temperatures.

3.4 FIELD QUALITY CONTROL

.1 Filling, Testing & Balancing: Tests of hydronic heating and/or cooling systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.

.2 Pressure gauges used in testing and balancing shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.

.3 Air Test

.1 Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.

.2 Do not exceed 150 psig.

.3 Use liquid gas detector or soap solution to check for leakage at manifold connections.

.4 Water Test

.1 Purge air from pipes.

.2 Charge the completed, yet unconcealed pipes with water.

.3 Take necessary precautions to prevent water from freezing.

.4 Check the system for leakage, especially at all pipe joints.

.5 Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig for 30 minutes.

.1 As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.

.2 At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.

.6 After successfully performing the preliminary pressure test, perform the main pressure test immediately.

.1 The test pressure shall be restored and continued as the main test for 2 hours.

.2 The main test pressure shall not fall more than 3 psig after 2 hours.

.3 No leakage shall be detected.

.7 Pressure shall be maintained and monitored during installation of the thermal mass.

.1 If any leak is detected during installation of thermal mass, leak shall be found immediately and the area cleared for repair using manufacturer's approved repair coupling.

.2 Retest before covering repair.

.8 Complete inspection and furnish test reports supplied by the manufacturer of the system.

3.5 CLEANING

.1 Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.

.2 Comply with manufacturer's recommendations.

3.6 PROTECTION

.1 Protect installation throughout construction process until date of final completion.

.2 Replace components that cannot be repaired.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.1 SECTION INCLUDES

.1 Grilles

.2 Louvres

1.2 REFERENCES

.1 ADC 1062 - Air Distribution and Control Device Test Code.

.2 AMCA 500 - Method of Testing Louvres for Ratings.

.3 ARI 650 - Air Outlets and Inlets.

.4 ASHRAE 70 - Method of Testing for Rating the Performance of Outlets and Inlets.

.5 SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

.6 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

.1 Shop drawings and product data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

.2 Samples: Submit two of each required air outlet and inlet type, if requested by the Consultant.

1.4 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 REGULATORY REQUIREMENTS

.1 Test and rate air outlet and inlet performance to ADC Equipment Test Code 1062 and ASHRAE 70.

.2 Test and rate louvre performance to AMCA 500.

2 Products

2.1 MANUFACTURER'S

.1 Grilles

.1 Krueger models indicated or equivalent products by;

.1 E. H. Price

.2 Titus

.3 Metalaire

Substitutions are subject to shop drawing review.

.2 Refer to the schedule on the drawings for grille models, types, performance requirements and finishes.

.2 Louvres

.1 Greenheck models indicated or equivalent by;

.1 Ventex

.2 Substitutions are subject to shop drawing review.

.2 Refer to the schedule on the drawings for louvre models, types, performance requirements and finishes

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's instructions.

.2 Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

.3 Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

.4 Paint ductwork visible behind air outlets and inlets matte black. Refer to section 09.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the General Requirements of Section 23 01 00 and the Common Work Results of Section 23 05 00.

.2 Division 01 requirements and documents referred to therein.

1.1 MECHANICAL ELECTRICAL SCHEDULE

.1 The following Mechanical Electrical Schedule is provided to assist the Contractor in co-ordinating the efforts of the sub-trades. The assignment of work among subcontractors is the Contractor's responsibility and the Contractor is free to amend the schedule as they deem necessary.

.2 The Mechanical Electrical Schedule also describes work that is required and may or may not be described elsewhere. All work indicated in the Mechanical Electrical Schedule shall be included in the Bid Price.

.3 The Mechanical Electrical Schedule shall not limit the extent of the Contract in any way. Work indicated elsewhere or otherwise needed for a complete and functioning installation shall be provided whether or not shown in the Mechanical Electrical Schedule.

1.2 RESPONSIBILITY CODES

.1 Responsibility Codes in the Mechanical Electrical Schedule shall be interpreted as follows:

.1 "Supplied by Div.": means that the equipment is to be supplied to the site under the Division described by number.

.2 "Installed by Div.": means that the equipment is to be received from the supplier, handled, set in place and installed at the site under the Division described by number.

.3 "Wired and connected by Div.": means that the equipment and its associated devices are to be wired and connected to the various electrical systems in accordance with the equipment manufacturer's installation instructions and wiring diagrams under the Division described by number.

2 Products

Not Used

3 Execution

3.1 MECHANICAL ELECTRICAL SCHEDULE

.1 Refer to Schedule on next page.

END OF SECTION

MECHANICAL ELECTRICAL COORDINATION SCHEDULE

No.	Equipment				Controls			Responsibility		
	Item	Characteristics		Location	Type	Location	Manufacturer's Reference	Supplied by Div.	Installed by Div.	Wired and Connected by Div.
1	Heat Recovery Ventilator [HRV-1] & [HRV-2]	MCA	8.7	Mech./Elec. Room & Mezzanine	Disconnect	At Unit		23	23	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls	Wall Mounted Controller		23	23	23
		Freq.	60		Occupancy Sensor Dry Contact			26	26	26
2	Heat Recovery Ventilator [HRV-3]	MCA	2.1	Storage Area	Disconnect	At Unit		23	23	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls	Wall Mounted Controller		23	23	23
		Freq.	60		Occupancy Sensor Dry Contact			26	26	26
3	Boiler [B-1] & [B-2]	MCA	15	Mech./Elec. Room	Disconnect	At Exit Door		26	26	26
		Voltage	120		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60		Cascade Boiler Control System			23	23	23
4	Boiler Circulation Pumps [P-3] & [P-4]	HP	1/6	Mech./Elec. Room	Disconnect	At Unit		23	23	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60							
5	Heating Coils Pump [P-5]	HP	1/12	Mech./Elec. Room	Disconnect	At Unit	ECM Motor	23	23	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls	Unit Mounted Controller		23	23	23
		Freq.	60							
6	In-Floor Heating Pump [P-6]	HP	1/6	Mech./Elec. Room	Disconnect	At Unit	ECM Motor	23	23	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls	Unit Mounted Controller		23	23	23
		Freq.	60							
7	Glycol Makeup Unit	HP	1/2	Mech./Elec. Room	Disconnect	At Panel		26	26	26
		Voltage	115		Starter	At Unit		23	23	26
		Phases	1		Other Controls					
		Freq.	60							
8	Unit Heater [UH-1]	HP	0.055	Mech./Elec. Room	Disconnect	At Unit		26	26	26
		Voltage	115		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60		Remote Line-Voltage Thermostat			23	23	26
9	Electric Duct Heater [EDH-1]	kW	2	Storage Area	Disconnect	At Unit		26	26	26
		Voltage	240		Comb. Starter					
		Phases	1		Other Controls					
		Freq.	60		Duct Temperature Sensor and Controller			23	23	23

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

.2 The requirements of this Section shall apply to and govern the work of this Division and shall be read as an integral part of each Section.

.3 The Electrical Drawings and these Specifications are complementary to each other and each forms a part of this contract. In the event of discrepancies between Drawings and Specifications, the more restrictive conditions shall apply unless a written clarification is obtained from the Consultant.

.4 Misinterpretation of any requirement of the Drawings or Specifications will not relieve this Division of responsibility to complete the work. If in doubt, contact the Consultant for written clarification. If clarification is not sought the Consultant's decision shall be final and binding on the Contractor.

.5 Do not scale drawings but use only dimensions, which are shown. Where exact building dimensions and details are required, use only figured dimensions on the Architectural or Structural Drawings or job site dimensions.

.6 No deviations from the Drawings or Specifications will be permitted without written authorization from the Consultant.

1.2 RELATED WORK

.1 Provide all labour, tools, services and installation (except as noted below) of all products.

1.3 RELATIONSHIP TO OTHER DIVISIONS

.1 Division 26 shall:

.1 Provide line voltage power wiring and terminations to equipment of all Divisions.

.2 Provide low voltage (31 to 750 volts) wiring to equipment of all other Divisions. Unless otherwise indicated on the electrical drawings Division 22/23/25 control and interlock wiring, extra-low (up to & including 30 volts) and/or low voltage not exceeding 120V shall be by Division 22/23/25.

.3 Provide starters and/or disconnects as noted on drawings.

1.4 SCOPE

.1 Generally, the work includes, in the time frame set out or implied, the provision of a complete, interfaced, reliable, continuous operating electrical systems shown, implied, described or required, including but not limited to all labour, equipment, confirmations, co-ordination of equipment, interim set-up and operation, spare parts, fees, service layouts, permits, inspections, investigations, studies, acceptance tests, including 3rd party, demonstrations, reports, bonds, notices, declarations, administration, liaison, reviews, meetings, correspondence and travel. Provide training, warranties and insurance.

.2 Refer to Division 1 for requirements regarding temporary power. Co-ordinate with power utility and/or supply portable generator equipment as required to complete scope of work.

.3 The electrical drawings are schematic and indicate major equipment and intended overall arrangement. Exact sizes, dimensions, locations, devices and arrangements shall suit equipment, site conditions and requirements. Review shop drawings for sizes and requirements under Division 26 and ensure compatibility of all systems specified and installed; report problems, concerns and variations. The Engineer shall review shop drawings of equipment prior to installation. Refer to Division 1.

.4 The Contract Drawings and the Specifications are to be read in conjunction with all other design and engineering documents. Provide all equipment after co-ordinating and reviewing all Division 26 work required by other Sections, service companies and jurisdictional authorities. The

omission of work and materials that are required to complete the project is not to be interpreted as relieving this Section of the necessity of providing such work and materials. Ensure all equipment is installed correctly and sequentially.

.5 In case of conflict among authorities, trades, drawings, specifications and other documents, the most stringent requirements shall apply, as directed by the Consultant.

.6 All work and material shall be installed to the manufacturer's and the Consultant's recommendations and satisfaction, as applicable. Construction shall be performed by relevant, competent, qualified and certified trade persons.

.7 Protect materials and equipment after delivery to minimize the probability of condensation or other damage prior to the application of final heating systems.

1.5 PERMITS AND ALLOWANCES

.1 The Consultant has submitted the Contract Drawings and specifications to the Electrical Safety Authority for approval (if required). ESA comments will be incorporated in the project using normal contract procedures. Co-ordinate and provide additional information as required. Inform the Engineer of any concerns noted prior to ordering equipment.

.2 Pay all Electrical Safety Authority permit and inspection costs.

.3 Co-ordinate with Supply Authority and provide additional information as required.

.4 Provide, in a timely manner, a copy of all applicable comments made by authorities having jurisdiction.

1.6 EXAMINATIONS

.1 Prior to submission of tender, carefully examine the electrical drawings, drawings of other trades and all Specifications having a bearing on the work of this Division. Visit the site of the work and thoroughly ascertain that the work of this Division can be carried out satisfactorily without any changes to the Drawings or Specifications. No extras will be allowed for anything, which would have been revealed in the course of such an examination.

.2 Examine the proposed locations of equipment and fixtures of other trades and report any defects or interference with the work of this Division in writing to the Consultant. Affected work shall not commence until any discrepancies adversely affecting the work of this Division are remedied.

.3 Fully understand the function of the systems described in this Division. Have no doubt as to the extent of the systems and/or materials and labour required. Contact the Consultant for clarification. No extras will be allowed to complete systems inadequately installed or not fully operational.

1.7 EXTRAS AND CREDITS

.1 Changes to the contract requiring additions to or deletions from the work of this Division shall be carried out upon written request of the Consultant. Extras to the contract or credits shall be submitted with a complete cost breakdown as follows:

.1 Materials, quantities and unit prices for all equipment required or deleted.

.2 Unit man hours.

.3 Total material cost.

.4 Total man hours.

.5 Hourly rate. (Refer to Supplementary Conditions and General Contract).

.6 Total overhead and profit. (Refer to Supplementary Conditions and General Contract).

.2 Equipment and material costs shall be accepted at net costs only.

.3 Invoices, time sheets, and other evidence of costs shall be provided upon request by the Consultant.

.4 Prices not submitted in this format will not be accepted.

1.8 REGULATIONS

.1 Comply with the latest Ontario Building Code and amendments and the requirements of the Municipal Building Department.

.2 Comply with the latest regulations of the Electrical Safety Code and the requirements of the local Electric Safety Authority inspection department, the requirements of the local hydro commission, the recommended standards of the Canadian Standards Association, the Ontario Ministry of Labour, the Occupational Health and Safety Act, Provincial and Federal governments or any other authority having jurisdiction.

.3 The Contract Drawings show the minimum standard acceptable regardless of any lesser standards set by any Codes, Regulations or Authorities Having Jurisdiction.

1.9 INTERRUPTIONS OF SERVICES

.1 To obtain permission for an interruption of electrical services, submit a request at least two weeks prior, stating the time the interruption is to begin, expected duration and the services and area affected. Interruption of services shall not proceed without approval of Consultant.

.2 Where in the opinion of the Consultant it is advisable or desirable to maintain service in the area or any part of the area involved during the interruption, provide such temporary wiring, equipment, etc., as required or as may be deemed necessary by the Consultant to maintain services. No additional payments will be made for any additional cost or inconveniences which may incur.

.3 Under no circumstances will the Contractor's operation be allowed to interfere with or interrupt the Owner’s use of the building.

1.10 SUBMITTALS

.1 Submit a list of delivery dates for each type of equipment, within 30 days of awarding of the contract or at the preconstruction meeting. The list shall include the manufacturer's name. Shop drawings shall indicate conformity with all items of the equipment specifications.

.2 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the construction schedule. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default is allowed.

.3 Work affected by the submittal not to proceed until the review is complete unless an approval is obtained from the Consultant.

.4 Review submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, and that each submittal has been checked and co-ordinated with the requirements of the Contract Documents.

1.11 SHOP DRAWINGS

.1 Submit shop drawings in accordance with the General Requirements of Division 1 and as required in various sections of these specifications and on the drawings.

.2 Shop drawings to be submitted with a cover sheet(s) on the Contractor's letterhead listing the following information:

.1 Project:

.2 Owner/Client:

.3 Architect:

.4 Electrical Consultant:

.5 General Contractor:

.6 Electrical Contractor:

.7 Supplier

.8 Specification Section

.9 Materials or Equipment submitted

Note: Include space for review stamps by Consultant, General Contractor and Electrical Contractor.

.3 Prepare and submit for review, where specified, shown or considered necessary by the Consultant, shop drawings showing details of work as follows:

.1 Descriptive names of equipment (as identified on drawings), manufacturer's model numbers and electrical characteristics.

.2 Physical dimensions of equipment.

.3 Sections, arrangements and details which indicate complete construction as well as interconnections with other work.

.4 Location and type of anchors and fastenings.

.5 Materials including gauges, thickness, sizes and finishes.

.4 Manufacturer's printed data sheets for standard items are acceptable providing pertinent characteristics are identified and relate to specified items. Submit eight (8) copies of data sheets except where specified otherwise.

.5 Check shop drawings and data sheets, before submission as follows:

.1 Against contract documents and other applicable shop drawings, to ensure that work adjacent to and affecting other work is accurately detailed.

.2 To ensure that work shown on shop drawings conforms to requirements of Contract Documents.

.3 Enclose notice in writing of any variations from requirements of Contract Documents.

.6 Indicate on shop drawings that they have been checked by applying stamp "checked and certified correct for construction", including date and Contractor's signature. Drawings and details submitted without such stamp or whenever it is evident that drawings have not been checked (despite approval stamp) will not be reviewed and will be returned to Contractor.

.7 The Consultant's review of shop drawings and data sheets pertain to general design only. Errors in dimensions, quantities or interference will be marked if noticed, but this will not in any way relieve Contractor from his responsibility to complete work as shown and specified.

.8 Shop drawings are to be returned with "Reviewed – No Comment", "Reviewed – As Noted", "Reviewed – Revise and Resubmit" or "Review by Consultant Not Required".

.1 "Reviewed – No Comment" - Drawings conform with the general design concept.

.2 "Reviewed – As Noted" - Drawings conform with the general design concept subject to the corrections noted. Drawings to be corrected and resubmitted for final review and incorporation into maintenance manuals. Such submission is not to hold up manufacture.

.3 "Reviewed – Revise and Resubmit" - Drawings are rejected and manufacture/supply of this equipment is not to proceed. Drawings are to be resubmitted with required corrections on equipment.

.4 "Review by Consultant Not Required".

1.12 CERTIFICATES

.1 Provide copies of all required certificates of approval, test results and verifications. Insert in Operating and Maintenance Manuals.

1.13 RECORD DRAWINGS

.1 As-built drawings are to be maintained in accordance with the general requirements of Division 1.

.2 The Consultant shall provide the Contractor with an extra set of white prints on which to show clearly in red ink, as the job progresses, all changes and deviations from the plans, including all changes as part of change orders, site instructions or site condition.

.3 Dimension all buried services/wiring from permanent structures.

.4 Maintain as-built drawings on site for periodic review by Consultant.

.5 On application for Certificate Of Substantial Performance, provide to the Consultant two complete sets of as-built drawings.

1.14 WARRANTY

.1 Provide warranty of material and workmanship in accordance with the requirements of Division 1.

.2 Provide manufacturers' standard warranty if greater than one year.

.3 The Contractor is to submit extended warranties for specific materials and/or work where specified. Extended warranties are to be issued on the Contractor's letterhead, under seal, and issued in the name of the Owner.

.4 Insert warranties in Operating and Maintenance Manuals.

1.15 OPERATING AND MAINTENANCE MANUALS

.1 Submit three (3) copies of Operation and Maintenance Manual individually bound in suitable sized hard backed three ring binders.

.2 Front cover of each binder to be suitably lettered as follows:

OPERATION AND MAINTENANCE MANUAL FOR

(Project Name)

(Owners Name)

(Date)

.3 Provide master index at the beginning of each binder indicating all items included in each section.

.4 Provide plastic tab indices for all sections of the manual. Provide separate sections for each major piece of equipment and for groups of smaller products.

.5 Provide list of names, addresses and telephone numbers of equipment suppliers, Electrical Contractor, General Contractor, Architect and Consulting Engineer.

.6 Provide final review shop drawings of each manufactured item in addition to the operating and maintenance instructions.

.7 Provide operating instructions. Operating instructions to include:

.1 General description of each electrical system.

.2 Step by step procedure to follow in commissioning each piece of equipment.

.3 Schematic control diagrams for each separate system.

.4 Drawings of each control panel identifying all components on the panels and their function.

.5 All electrical equipment wiring diagrams.

.8 Provide maintenance instructions. Maintenance instructions are to include:

.1 Manufacturer's maintenance instructions for each item of electrical equipment installed under this Division. Instructions are to include installation instructions, parts numbers and lists, name of supplier and maintenance instructions.

.2 Summary list of each item of electrical equipment requiring maintenance, indicating the name of the equipment item, maintenance required and frequency of maintenance.

.9 Provide written warranty (or warranties as applicable) on the Contractor's letterhead addressed to the Owner, copied to the General Contractor.

.10 Include certificates issued by regulatory authorities (ESA, etc.), test and/or verification reports, programming parameters for devices with field adjustment capabilities and a list of ranges and set-points at final commissioning.

1.16 SPARE PARTS

.1 Provide three (3) spare LED lights of each type used.

.2 Provide two (2) spare LED drivers of each type used.

.3 Provide two (2) spare fusible links of rated ampacity for each two-pole fused disconnect type used.

2 Products

2.1 MATERIAL

.1 All material shall be specification grade, where applicable, new and carry CSA approval or special approval in accordance with ESA requirements.

.2 Similar devices and items shall be from one manufacturer throughout the project.

.3 Material or equipment specified by technical description shall be provided with the best commercial qualities obtainable for the purposes described.

.4 Requests for extra money, time or equipment substitution due to late ordering of equipment will not receive any consideration.

2.2 ALTERNATE MATERIALS

.1 Whenever a substitute or alternate product is proposed for use, the Contractor shall guarantee that such proposed substitutes or alternates will not adversely affect the requirements allocated on the drawings for the material or item or plant or equipment specified. He shall agree to bear any additional expense incurred due to the use of proposed substitutes or alternates, particularly in connection with any required changes in the work of any other division.

.2 Requests for approval shall be accompanied by complete specifications for the equipment, showing dimensions, ratings, photometrics, cost reductions, etc.

.3 Any equipment installed, without the Consultant's written approval, shall be removed and the correct equipment installed at no extra cost.

.4 In the event the approved alternate equipment is not available for any reason, the specified equipment shall be installed.

.5 When proposing an alternative product make all affected parties aware of any structural, architectural, mechanical, or electrical design changes necessary to accommodate the alternative product. The contractor is responsible for paying all costs incurred, which may result, from the acceptance of the alternative. Any cost savings anticipated must include all additional costs incurred for any changes to the original design.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring, conduit and connections: provided by Division 26 where voltage exceeds 120V, provided by Division 22/23/25 where voltage is 120V or less.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify all panels, starters, disconnect switches, etc. with approved, mechanically fastened lamacoid nameplates. Indicate equipment being controlled, voltage and the supply panel/device and its location.

.2 Labels on fused disconnect switches to include size and type of fusing. Also indicate "Equipment to be off before Isolation".

.3 Terminal cabinets, junction boxes and pull boxes: indicate system and voltage and/or circuits.

.4 Use 3mm (1/8”) thick lamacoid plates. White colour background with 6mm (1/4") high black letters. Use client equipment numbers as required.

.5 Within panel boards, provide a typewritten directory of all circuits identifying the loads connected.

.6 Provide warning signs, as specified or to meet requirements of Inspection Department and Consultant. Use porcelain enamel for outdoor and decal for indoor signs, minimum 175 x 250 mm size.

2.5 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, metal sheathed cables and junction boxes. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling or floor and at 3050mm (120”) intervals. Colours to be 25mm (1”) wide as follows:

.1 Fire Alarm, Red

.2 Telephone, Green

.3 Emergency Power, Blue

2.6 WIRING IDENTIFICATION

.1 All wiring shall be colour coded and shall be identified at each end with Brady self-sticking Permacode wire markers. Update and or indicate numbers on "as-built drawings".

.2 Maintain phase sequence and colour coding throughout. Colour coding to CSA C22.1.

.3 Use colour coded wires in communication cables, matched throughout system.

3 Execution

3.1 EQUIPMENT INSTALLATION

.1 Do complete installation in accordance with OESC except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 and CSA C22.3 No.7 respectively, except where specified otherwise.

.3 The location of any panels, equipment, outlet, raceway and wiring may be changed by the Consultant if the new location is within a limit of 3000mm (120”) radius of the original location. Provide changes without extra cost if requested before installation.

.4 Do not install wall-mounted equipment at locations where built-in furniture or other equipment is to be installed. In cases of conflict, install equipment above the built-in furniture and clear the trim by approximately 150mm (6") unless otherwise instructed by the Consultant.

.5 Arrange for openings in the walls and floors for transportation and installation equipment. Extra charges for cutting and making good of walls or floors for the work will not be accepted.

.6 Prior to installation and start up, co-ordinate and confirm that all electrical equipment and systems are compatible, are sized correctly and shall work safely as intended.

.7 Provide an acceptable documented procedure for the commissioning of all systems. Contact the Consultant to arrange for a viewing of the system demonstration. All systems shall be fully operational and verification documents available at least 24 hours before requesting a review by the Consultant. Provide hard copies of all programs for review before and after commissioning of equipment. At the discretion of the Owner, back charges for costs incurred may be levied if systems are not commissioned and operational at the time of the Consultants visit and return visit(s) are required.

.8 Install, program, set-up and adjust all equipment as indicated and or required and complete all commissioning.

.9 Electrical work is indicated generally on the Contract Drawings by standard symbols as per the legend. The letters in the symbol indicate the type of device as per the schedules. The letters and numbers outside and adjacent to the symbols indicate the panel and circuit number. If no circuit identification is indicated utilize available circuit(s) and load to acceptable practices.

.10 All row mounted fixtures shall be accurately installed in line with all mounting hardware.

.11 Support every outlet box, junction box, panel tub, etc. independent of conduits running to it.

.12 Surface mounted distribution and control equipment shall be mounted square and level on flame retardant backboard.

.13 Transformers, switchboards and motor control centres shall be mounted on housekeeping pads.

.14 Mount exit lights at a level so that they are clearly visible and to the satisfaction of authorities having jurisdiction.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.2 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50mm (2”). All holes through concrete or steel structural members shall be approved by the Structural Consultant.

.3 Install cables, conduits and fittings close to building structure so furring can be kept to minimum.

3.4 EQUIPMENT MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless indicated otherwise. Verify unspecified heights and dimensioned locations before installation. Ensure indicated heights are per current Barrier Free access requirements before installation. Stagger back to back devices (such that they are not located in a common stud wall cavity) to reduce sound transfer and maintain fire separations.

.2 Install switches, receptacles, devices, etc. on one common centre line when shown on the drawings in a grouping.

.3 The top of recessed boxes to be mounted even with the nearest top of block. Alternatively, the bottom of recessed boxes may be mounted even with the nearest bottom of block.

.4 Generally install electrical equipment at following heights unless indicated otherwise on drawings:

.1 Light switches and thermostats in public spaces: 1200mm (47").

.2 Pit light switches: 305 mm (12") below hatch, right side (preferred).

.3 Wall receptacles:

.1 General: 405mm (16").

.2 Height above top of counters or counter splash backs: 175mm (7").

.3 Mounted high (refrigerator, etc.): 1120mm, (44").

.4 In mechanical rooms: 1120mm (44").

.4 Panelboards: as required by Code or as indicated (Maximum circuit breaker height 1700mm (67")).

.5 Exit lights at ceiling height, to a maximum of 2290mm (90"). Confirm visibility before installation.

.6 Wall mounted emergency lights: 2440mm (96").

.7 Handicap door release/opener button & washroom lights: 1016mm (40").

.8 Motor starters, generally: 1400mm (55").

.9 Telephone outlets: 400mm (16”).

.10 Wall mounted telephone outlets: 1372mm (54”).

.11 Television outlets: as noted on drawings.

.12 Hand dryers: 1200mm (47”).

3.5 CLEAN-UP

.1 Continuously remove surplus and waste material generated by the electrical work.

.2 Clean all supplied equipment and material of dirt, dust and stray paint, immediately prior to final acceptance of the work.

.3 Remove tools, surplus material, scrap and debris (resulting from the work of this Division) on completion of the Contract.

.4 Clean and touch-up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.5 Clean, prime and paint exposed non-galvanized hangers, racks and fastenings to prevent corrosion.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Verify prior to energizing of circuits

3.7 TESTING

.1 Furnish labour, materials, and instruments and bear other costs in connection with all tests, including third party and factory tests, obtain required certificates of approval, acceptance, and compliance with regulations of agencies having jurisdiction and as specified.

.2 Confirm proper operation of each piece of equipment and system for correct function.

.3 Measure amperage readings of each phase at service entrance switchboard and on each panel/equipment feeder. Ensure phase imbalance does not exceed 10% at operating load conditions. Adjust loads as required.

.4 Megger test all feeders prior to energizing; submit test results in Operating & Maintenance Manuals. Provide insulation resistance testing on service entrance cables, panel feeders and feeders to major equipment. Testing to be completed as follows:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

Note: Check resistance to ground and conductor to conductor resistance for conductors in the same conduit before energizing.

.5 Measure voltage at service entrance switchboard, at feeder supply connections and at load connections. Measurements to be taken under normal operating conditions. Submit test results in Operating & Maintenance Manuals.

.6 Confirm continuity of metal raceways where raceway is used in lieu of a bonding conductor.

.7 Demonstrate that the settings described in the co-ordination study have been incorporated.

3.8 INSPECTIONS

.1 Inform the Consultant in writing a minimum of 3 working days prior to any test of any system.

.2 All work and materials covered by these Specifications shall be subject to inspection at any time by the Consultant.

.3 If the Consultant finds that any material or workmanship does not conform to these specifications undertake to correct such workmanship within 5 days of notification by the Consultant.

.4 Work shall not be deemed complete and Certificate of Substantial Performance will not be issued, until all indicated certificates of approval, test results and/or verifications have been delivered to the Consultant.

.5 Notify the Consultant when the final inspection of the work shall be performed. Defects or deficiencies found during this inspection shall be corrected to the satisfaction of the Consultant before final payment is made.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Electrical Requirements, Section 26 05 00.

1.3 REFERENCES

.1	CSA C22.2 No. 41	Grounding and Bonding Equipment
.2	CSA C22.2 No. 38	Thermoset Insulated Wires and Cables.
.3	CSA C22.2 No. 51	Armoured Cables.
.4	CSA C22.2 No. 52	Underground Secondary and Service- Entrance Cables.
.5	CSA C22.2 No. 75	Thermoplastic-Insulated Wires and Cables.
.6	CSA C22.2 No. 83.1	Electrical Metallic Tubing - Steel.
.7	CSA C22.2 No. 211.1	Rigid Types EB1 and DB2/ES2 PVC Conduit.
.8	CSA C22.2 No. 211.2	Rigid PVC Conduit.
.9	CSA C22.2 No. 45.1	Electrical Rigid Metal Conduit – Steel
.10	CSA C22.2 No. 45.2	Electrical Rigid Metal Conduit – Aluminum, Red Brass & Stainless Steel
.11	CSA C22.2 No. 56	Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
.12	CSA C68.3	Power Cables with Thermoset Insulation.
.13	CSA C22.2 No. 85	Rigid PVC Boxes and Fittings.
.14	CSA C22.2 No. 18.1	Metallic Outlet Boxes
.15	CSA C22.2 No. 18.2	Non-Metallic Outlet Boxes
.16	CSA C22.2 No. 18.3	Conduit, Tubing and Cable Fittings
.17	CSA C22.2 No. 18.4	Hardware for the Support of Conduit, Tubing and Cable
.18	CSA C22.2 No. 40	Cutout, Junction and Pull Boxes.
.19	CSA C22.2 No. 65	Wire Connectors.
.20	CSA C22.2 No. 14	Industrial Control Equipment.
.21	CSA C22.2 No. 177	Clock-Operated Switches
.22	CSA C22.2 No. 42	General Use Receptacles, Attachment Plugs, and Similar Wiring Devices
.23	CSA C22.2 No. 42.1	Cover Pates for Flush Mounted Wiring Devices
.24	C22.2 NO. 182.1	Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type
.25	C22.2 NO. 182.2	Industrial Locking Type, Special Use Attachment Plugs, Receptacles and Connectors
.26	C22.2 NO. 182.3	Special Use Attachment Plugs, Receptacles and Connectors
.27	CSA C22.2 No. 4	Enclosed and Dead-Front Switches
.28	CSA C22.2 No. 111	General Use Snap Switches
.29	CSA C22.2 No. 55	Special Use Switches
.30	CSA C22.2 No. 106	HRC Miscellaneous Fuses
.31	CSA C22.2 No. 248	Low-Voltage Fuses

1.4 SCOPE

.1 Provide wiring and equipment as detailed on the Contract drawings and specified herein.

1.5 SHOP DRAWINGS

.1 Submit shop drawings for the equipment detailed within this specification section. Shop drawings shall be submitted in accordance with Section 26 05 00 General Electrical Requirements and the requirements of Division.

2 Products

2.1 MATERIAL

.1 All material shall be specification grade, where applicable, new and carry C.S.A. approval or special approval in accordance with the requirements of the Electrical Safety Authority.

.2 Similar devices and items shall be from one manufacturer throughout the project.

2.2 WIRING

.1 All conductors, unless specifically noted otherwise, shall be copper with 600 volt, x-link insulation. Temperature rating to be 90□C or as required by Code.

.2 All conductors shall be colour coded consistent with the Ontario Electrical Safety Code.

.3 Conductors up to and including # 10 may be solid copper. Larger conductors shall be stranded.

.4 Branch circuit wiring shall be #12 AWG minimum. For circuit (15Amp, 120VAC) lengths exceeding 30m (100') minimum size shall be #10 AWG and for circuit lengths exceeding 45m (150') minimum size shall be #8AWG. Size wiring to maintain a maximum of 2% voltage drop.

.5 Control wiring to be #16 AWG minimum. Size wiring to maintain a maximum of 2% voltage drop.

.6 Wiring in dry locations shall be: R90 or RW90 installed in EMT conduit (unless noted otherwise).

.7 Wiring in damp locations shall be: RW90 in conduit (conduit type as noted on drawings).

.8 Underground service entrance wiring shall be RWU90 in PVC duct or conduit.

.9 Armoured cable (AC90) shall be permitted for exposed wiring in dry locations only.

.10 All feeders shall be run in continuous length between power supply point and the load with no splices.

.11 Do not share neutrals between lighting circuits.

.12 Sleeve and seal wiring and conduit penetrations through walls and floors per Ontario Building Code requirements.

.13 Wiring in fire rated partitions shall be armoured cable.

2.3 CONDUIT

.1 EMT conduit shall be utilized for typical wiring. Conduit to be concealed wherever possible.

.2 Where conduit is surface mounted and subject to mechanical damage, use rigid galvanized steel threaded conduit to a minimum of 2.4m (8') above finished floor level. Use electrical metallic tubing (EMT) above 2.4m (8').

.3 Direct buried conduit shall be rigid PVC conduit with bond, as permitted by Code.

.4 Seal tight (flexible, PVC jacketed, metallic) conduit shall be used to connect motors and vibrating equipment; minimize length of runs where possible.

.5 Concrete encased conduit shall be PVC type DB2 duct with bond wire, as permitted by Code. The minimum cover to concrete surface shall be 50 mm.

.6 Minimum conduit size for lighting and power circuits shall be 21 mm (3/4") unless otherwise stated. All buried conduit or conduit embedded in concrete shall be minimum 27 mm diameter.

.7 Provide all pull boxes, junction boxes, terminal boxes, fittings, drains, plugs, cover plates, bushings, clips, rods and accessories as required and appropriate.

.8 EMT conduit connectors to be c/w steel set screw.

.9 Where the potential for box submergence exists, the box is to have a submersible rating with all fittings designed and installed to prevent the entry of water.

.10 Supports for conduit, cable or equipment shall be corrosion resistant (galvanized steel or equivalent).

2.4 WIRING DEVICES AND COVERPLATES

.1 General

.1 Colour of devices and cover plates (other than stainless) to be confirmed by Consultant.

.2 Receptacles in office areas that are identified to be switched by occupancy sensing devices shall be gray in colour to differentiate from non-switched receptacles.

.3 Acceptable Manufacturers: Hubbell, Bryant, Pass & Seymour, Leviton.

.4 All devices to be of the same manufacturer throughout.

.2 Switches

.1 Digital manually operated lighting switches, integral part of Digital Light Management (DLM) system. Refer to 26 09 24 - Lighting Control Devices.

.2 Digital manual and occupancy sensor operated lighting switches, integral part of Digital Light Management (DLM) system. Refer to 26 09 24 - Lighting Control Devices.

.3 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 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 riveted grounding contacts.

.2 Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, with features detailed above for 15A device.

.3 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.4 Other receptacles with ampacity and voltage as indicated.

.4 Duplex or single Ground Fault Interrupter Receptacle

.1 Rated 15A or 20A (as per drawings), 125VAC, U-grounded type.

.2 Class A requirement, trip level 4-6 mA, parallel blade, with test and reset switches, CSA 5-15R/20R configuration.

.5 Single receptacles CSA type L6-15 R, 250V, 15A.

Note: Except as specifically indicated, provision of either GFI receptacle or GFI circuit breaker will be acceptable to ensure ground fault protection of circuits as shown.

.4 Coverplates

.1 Cover plates shall be from one manufacturer throughout project.

.2 Stainless steel (302/302), smooth cover plates, for wiring devices mounted in flush-mounted outlet box.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof locations: Provide cast aluminum cover ("while-in-use cover) complete with adapter plate and gaskets. Cover shall have "wet location" rating with or without a plug inserted into the receptacle.

2.5 OUTLET & CONDUIT BOXES

.1 General

.1 Gang boxes where wiring devices are grouped.

.2 Provide blank cover plates for boxes which are roughed in only. Cover plate style as detailed above.

.3 Provide combination boxes with barriers where outlets for more than one system are grouped.

.2 Galvanized Steel Outlet Boxes

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm (3" x 2" x 1½") or as indicated. 102mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48mm (4" x 2" x 2").

.4 102mm (4") square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished tile walls.

.3 Masonry Boxes

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

.4 Concrete Boxes

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

.5 Conduit Boxes

.1 Where subject to mechanical damage (or as noted on drawings) provide cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 GROUND & BONDING

.1 Provide all grounding to the authorities' approval. Use approved connection methods (thermal weld or compression). Provide appropriate mechanical protection for all ground wire.

.2 Provide appropriately sized ground or bond wire in all conduit systems; including EMT, steel and PVC types.

.3 Provide #6 AWG insulated bond wire main service ground to:

.1 Communications cabinet.

.4 Install 20 X 3000mm long copper clad steel rod electrodes and make grounding connections at electrical service entrance.

.5 Engage the services of an independent contractor to undertake a ground resistance measurement on the grounding system prior to termination and backfill. A log of measurements shall be provided. Notify the Engineer if the resistance of any rod is greater than 5 ohms.

.6 Bond all copper and metal plumbing pipes to ground.

2.7 JUNCTION & PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25mm (1”) minimum extension all around

.3 Covers Surface Mounted: screw-on flat steel covers.

2.8 CABINETS

.1 Construction: welded sheet steel, hinged door, handle, lock (2 keys) and catch. Corrosion protected surfaces to EEMAC 3R. Cabinets in exterior locations shall be stainless steel construction to EEMAC 4X.

2.9 SUPPORTING DEVICES

.1 Every conduit or cable shall have at least one support. Only approved conduit supports will be accepted. Perforated pipe straps, tie wrap or wood support for conduits or outlet boxes etc., will not be accepted.

.2 Single conduit runs: Galvanized conduit straps, ring bolt type hangers or P.V.C. saddles.

.3 Horizontal multiple raceways runs: Conduit rack with minimum 25 percent spare capacity. Trapeze style hanger on threaded rod.

.4 Vertical multiple raceway runs: Electrical strut fastened to structure.

.5 Strut Channels and Components

.1 General: Strut shall be 1-5/8 inches wide in varying heights and welded combinations as required to meet load capacities and designs indicated on the drawings.

.2 Materials and Finish: Hot-dip Galvanized Steel.

.1 Strut shall be manufactured from steel and hot-dip galvanized after fabrication.

.2 Fittings shall be manufactured from steel and hot-dip galvanized after fabrication.

.3 All hardware shall be stainless steel Type 304 or chromium zinc ASTM F1136 Gr. 3.

.3 Acceptable Manufacturers: Cooper B-Line, Thomas & Betts

2.10 ACCESS DOORS

.1 Provide access doors in walls and ceilings to service electrical equipment and concealed devices requiring access. Positive latch system. Minimum 18 gauge steel.

.2 Group devices to minimize doors. Access doors in fire separations are to be ULC labelled. Doors shall match finish and be flush with surface.

.3 All sizes and locations of doors shall be approved in writing by the Owner and or Engineer before installation.

.4 Provide hinged doors for all access panels with a size of 450 x 450 (18" x 18") or larger.

2.11 CUTTING & PATCHING

.1 At all penetrations of the roof, walls and floors and/or as indicated on the Contract Drawings provide Portals Plus Alumi-Flash, Pipe Portal, Pipe Boots and Quadraseals or Portals Plus Retrofit as manufactured by Portals Plus, Inc. and distributed by D.E.L. Roofing Equipment, 905 856 0333. Seals shall be installed to the manufacturer's recommendations, instructions and to the satisfaction of the Engineer.

.2 Cut and patch holes located incorrectly.

.3 Pneumatic hammers, drills, or explosive fasteners shall not be used without prior written approval from the Owner and/or Consultant.

.4 Openings on all electrical metal boxes shall be punched or cut.

2.12 FIRE STOPPING (ELECTRICAL / MECHANICAL ROOM)

.1 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases.

.2 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.3 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.

.4 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.

.5 Fire stopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.6 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes.

.7 Acceptable Manufacturers:

.1 Fyresleeve Industries Inc.

.2 General Electric Pensil Firestop Systems

.3 International Protective Coatings Corp.

.4 Rectorseal Corporation (Metacaulk)

.5 Proset Systems

.6 Minnesota Mining and Manufacturing (3M)

.7 Tremco.

.8 Hilti

.8 Submit shop drawings in accordance with Section 260500 for the following items:

.1 Fire stopping materials.

.2 Manufacturers literature and installation instructions.

.3 Manufacturers Letter of Certification that project meets or exceeds specified requirements.

2.13 MOTOR STARTERS

.1 Manufacturers: Allen Bradley, Schneider Electric, Cutler Hammer, Siemens.

.2 All starters shall be EEMAC rated.

.3 Manual Starters: Single phase, single and two pole - c/w pilot light and thermal overloads. EEMAC rated enclosure as required. Rated 115/230 volts. Sized as required for motor load to be controlled.

.4 AC Combination Magnetic Starters (FVNR unless noted otherwise) for Automatic Control of Single Phase Loads:

.1 Provide each starter with an operating coil and adjustable, manually resettable, ambient compensated overload and phase loss relay, each motor phase winding to be sensed. Provide “Reset” pushbutton for the overload relays.

.2 Overload relays for each line voltage connection and heater elements to match nameplate FLA of motor controlled.

.3 Provide control transformer (size as required, minimum 50VA) complete with primary fusing (HRC type). 120VAC secondary winding to be fused and grounded.

.4 Provide one normally open and one normally closed, 120V auxiliary interlock contacts.

.5 Provide 'push to test' LED type pilot lights (2) to indicate 'Run' (red), 'Stop' (green) and 'Fault' (amber).

.6 Fusible, 2 pole load break disconnect style switch c/w HRC time delay fuses.

.7 Operating voltage of coil to match voltage of operating system.

.8 Provide H.O.A. switching as noted.

.5 Enclosures shall be EEMAC type 3R surface mounted unless specified or shown otherwise on the drawings. Use EEMAC type 4X in weatherproof applications.

2.14 DISCONNECT SWITCHES

.1 Disconnect switches shall be fusible or non-fusible as required. Refer to drawings for details regarding type of switch, voltage, amperage/HP, etc. Switches shall be supplied complete with the following features:

.2 CSA approved.

.3 Horsepower rated.

.4 Provision for padlocking in on or off switch position.

.5 Quick-make, quick-break action. 100% load make / load break rated.

.6 ON-OFF switch position indication on switch enclosure cover.

.7 Mechanically interlocked door to prevent opening when handle in ON position.

.8 Suitable for service entrance use

.9 Fuseholders for type and size of fuse indicated. Provide fuses for each fused disconnect switch and three spare fuses for each size/type of fuse specified on project.

.10 CSA Enclosure type 1. Where indicated as 'Weatherproof' provide CSA Enclosure type 4X.

.11 All materials of similar type shall be of one manufacturer. Acceptable Manufacturers: Bryant, Cutler Hammer, Schneider Electric, Siemens.

2.15 FUSES

.1 HRC fuses rated 200 amperes and smaller shall be CSA certified HRCI-J fuses of the type(s) specified below.

.2 Fuse interrupting rating shall be 200,000A RMS symmetrical, unless otherwise noted.

.3 Time Delay fuses shall carry 500% of the rated current for a minimum of ten seconds and shall be labelled "Time Delay" by the manufacturer. (Exception: fuses rated 250V, 15-30A, an 8 second delay is permitted).

.4 Provide two spare fuses of each type and size installed. Provide spare fuse storage cabinet.

.5 Select fuses to provide a fully co-ordinated system for both overload and short circuit fault conditions.

.6 Unless otherwise noted on the drawings, Time Delay fuses for overcurrent protection of motor circuits are to be rated up to 150% of motor full-load current.

.7 Manufacturers: Cooper/Bussman, Mersen/Ferraz Shawmut/Gould, Littelfuse.

2.16 FLOW METER

.1 Provide a flow meter for measurement of sanitary waste discharged from the Hub facility.

.2 The flow meter installation shall include the following components:

.1 Flow transmitter

.2 Ultrasonic sensor for measurement within the pipe.

.3 Sensor cable for connection of sensor to transmitter. Allow for 50 metres of cable length; confirm required length prior to shop drawing submission.

.4 Pipe mounting system for installing the sensor in the pipe.

.5 Over-voltage protection modules.

.6 Intrinsic safety barriers (to serve wiring to the sensor located in hazardous area).

.7 NEMA 4X enclosure to house flow transmitter, protection modules, safety barriers, terminal strips and related ancillary devices.

.8 Terminal strips and circuit breakers/fuses as required for flow transmitter wiring and ancillary devices.

.3 Flow meter shall be Nivus NivuFlow 750 or approved equivalent.

2.17 LIQUID LEVEL MONITOR/CONTROLLER

.1 Provide an ultrasonic liquid level monitor/controller for control of potable water level within the potable water cistern.

.2 The liquid level monitor/controller shall monitor the potable water level within the water cistern and start/stop the well pump to maintain the water level within established minimum/maximum levels.

.3 The ultrasonic level monitor/controller installation shall include the following components:

.1 Level controller with wall mounted standard enclosure.

.1 Power Input: 120VAC

.2 Signal Input: Analog 4-20mA (from transducer)

.3 Output Relays: 4 x SPST Form A + 2 x SPDT Form C.

.2 Ultrasonic transducer (with mounting hardware) for measurement within the cistern.

.3 Transducer cable for connection of transducer to instrumentation cable at local junction box.

.4 The liquid level monitor/controller shall be Siemens MultiRanger 200 or approved equivalent.

3 Execution

3.1 GENERAL

.1 Verify all wall and partition locations, door swings, light switch and other device locations.

.2 Install all equipment according to manufacturer's recommendations with adequate access and clearances.

.3 Provide acceptable painted metal shroud over cables and conduits around exterior or public areas to prevent climbing, as required.

.4 Install all equipment according to manufacturer's recommendations with adequate access and clearances.

.5 All wiring, receptacles, light switches to be added to finished existing walls shall be concealed if possible. If surface mounted equipment and wiremold raceway is proposed its location and type must be approved by the Owner before installation. At tender specify where surface equipment and conduits are proposed to be installed.

.6 Correct improperly installed work as directed by the Consultant or authorized inspector.

3.2 SHORT CIRCUIT AND COORDINATION STUDY

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Verify prior to energizing of circuits.

3.3 WIRING

.1 Maximum armoured cable (BX) length of 3 m (10ft) is acceptable in the ceiling space, use EMT conduit otherwise. Minimum lengths of armoured cable may be used in furred ceilings, hollow partitions and hollow walls. EMT only in masonry walls unless otherwise approved. No BX may lay on or clip to ceiling tiles or terminate in panels.

.2 Conductor length for parallel feeders to be identical.

.3 Wire or cable used for feeders shall be free of splices.

.4 Systems of different voltages shall be installed in separate raceways.

3.4 CONDUITS

.1 Provide and locate all sleeves required to pass wiring through building walls and floors and ceilings. Fill voids between conduits and sleeves with material and caulking sealant to suit application and fire rating.

.2 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

.3 Provide complete metal conduit system for door entry wiring.

.4 Provide empty conduit systems for phone, computer, cable TV outlets or as designated. Conduit as indicated or as a minimum: 21 mm (¾") EMT conduit from the outlet to 150 mm (6”) above the ceiling panel. Provide outlet boxes, cover plates, junction and pull boxes and fireproof backboards as required.

.5 Telephone, Computers and Cable TV shall be wired by the Owner authorized company. Provide the authorized installers for these systems with estimated installation dates at the start of construction and two weeks prior to estimated pre-wiring dates. Provide raceways from outlets to accessible ceiling space. Co-ordinate with the end user authority and follow applicable installation guidelines.

.6 Co-ordinate with all trades to locate conduits in slabs, as required, before concrete pouring, record routing on prints.

.7 Co-ordinate and record exact routing of underground ducts and conduits. Establish elevation of ducts, schedule of work before installation.

.8 Supply and install expansion couplings where conduits cross construction joints.

.9 Install conduits on surface at lower trough of roof decking.

.10 All conduit and wiring within the building shall be run neatly and parallel to the building structure, above finished ceilings, within finished walls or below the floor. Conceal conduits as much as practical. It shall be supported from the building structure. Minimize horizontal runs along walls. Nails or tie wires are not acceptable. Do not caddie clip to ceiling hangers.

.11 Provide fish wire in all empty conduits.

3.5 WIRING DEVICES

.1 Switches:

.1 Digital switches shall communicate with DLM room controllers.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount switches at height in accordance with Section 260500 General Electrical Requirements unless noted otherwise.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Generally mount receptacles with U-ground oriented down.

.3 Mount receptacles at height in accordance with Section 260500 General Electrical Requirements unless noted otherwise.

.4 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.5 In office areas, 50% of the receptacles shall be switched based on room occupancy in accordance with the requirements of the OBC and ASHRAE 90.1 standard. Utilize plug load control devices (supplied with lighting controls) for occupancy switching of noted receptacles. Ensure switched receptacles are a distinct colour (grey) from non-switched receptacles.

.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.

3.6 OUTLET AND CONDUIT BOXES

.1 Gang power, voice and data outlets using gang boxes with barriers. Coordinate with voice and data wiring supplier and provide combination cover plates to suit.

.2 Mount all boxes, plumbed-true on vertical installations. Mount level on horizontal installations.

.3 In finished areas, all boxes to be installed flush mounted.

.4 All boxes to be supported independent of conduits or cables.

.5 Openings in all boxes shall be punched or cut, no burning of holes allowed.

.6 Fill all K.O. openings not used with proper filler plates.

.7 Door swings are to be determined from the Architectural drawings for switch locations.

.8 A variation of location of 3 m (10') shall be provided without cost to the Owner if requested before installation of equipment.

3.7 GROUNDING AND BONDING

.1 Install complete permanent, continuous grounding and bonding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run bond 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, permanent mechanical connectors or inspectable wrought copper compression connectors.

.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 Connect building structural steel and metal siding to ground by welding copper to steel.

.10 Make bonding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.11 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.12 Equipment Grounding

.1 Install grounding connection to service entrance equipment. Provide bonding connections to typical equipment included in, but not necessarily limited to following list:

.1 Transformers, duct systems, frames of motors, starters, control panels, building steel work, distribution panels, and outdoor lighting.

.2 Mechanical plumbing pipes (copper or steel), all water closet flush valve rough-ins, all lavatory electrically activated valve rough-ins, lavatory integrated hand dryers and soap dispenser rough-ins.

3.8 JUNCTION AND PULL BOXES

.1 Install junction and pull junction boxes so they are supported independent of raceways.

.2 Install pull boxes after every 30 m (100') of continuous raceway.

.3 Locate pull boxes above accessible ceiling spaces in inconspicuous locations wherever possible.

.4 Colour code pull boxes to indicate system involved.

3.9 CABINETS

.1 Mount all surface mounted equipment enclosures on an approved fire rated backing, or uni-strut channels.

.2 All recessed enclosures shall have trim for recessed mounting.

.3 Enclosures mounted in finished areas shall be finished to match.

.4 Terminate wiring in screw type terminal blocks or strips.

3.10 SUPPORTING DEVICES

.1 Install supporting devices to maintain headroom and clearances as described for conduits and conductors.

.2 Maintain a neat appearance and follow building lines where possible.

3.11 ACCESS DOORS

.1 Provide access panels where required for electrical equipment concealed in walls, partitions or floors. Location and type of access panels shall be to the Consultant's approval.

.2 Paint access panels to match surrounding decor or as directed by the Consultant on site.

.3 Keep access doors to a minimum by locating equipment in easily accessible locations.

3.12 FIRE STOPPING

.1 Confirm location and extent of fire separations from architectural drawings.

.2 Inspect surface to be fire stopped. Report unsatisfactory conditions to Consultant in writing prior to commencement of work. Initiation of work to be deemed as acceptance of conditions and surfaces.

.3 Store all materials in accordance with manufacturers recommendations as to acceptable ambient temperatures. Damaged or deteriorated materials are not to be used and are to be removed from the site.

.4 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer’s instructions in all conduit, cable, duct etc. penetrations in new or existing fire separation to provide temperature, flame and smoke rated seals not less than the fire resistance rating of the assembly, or separation.

.5 Seal all holes made by through-penetrations and un-penetrated openings to ensure continuity and integrating of fire separation, including where existing component or device has been removed.

.6 Notify Consultant and/or Authority having jurisdiction for inspection prior to concealing or enclosing fire stopping materials and service penetrations.

.7 Remove excess material and debris and clean adjacent surfaces immediately after application. Leave in a tidy condition.

3.13 CONTACTORS

.1 Install contactors and connect auxiliary control devices.

.2 Locate contactors in a convenient location for accessibility and service. Wherever possible, locate in service spaces such as electrical rooms, mechanical rooms, janitors closets, etc. Provide a self-supporting mounting surface where required.

.3 Label each contactor to indicate the device it controls.

3.14 MOTOR STARTERS

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses are installed in starters.

.4 Confirm motor nameplate and adjust overload devices to suit.

.5 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.15 DISCONNECT SWITCHES

.1 Label each disconnect switch to indicate the device it controls.

.2 Provide a separate self-supporting structure to support the disconnect device where the equipment or adjacent walls are not capable of supporting the device.

.3 Install fuses in fused disconnect switches as detailed on drawings.

3.16 FUSES

.1 Ship fuses in original containers

.2 Do not ship equipment with fuses installed.

.3 Store spare fuses in original containers in fuse storage cabinet. Install fuse storage cabinet in electrical room.

.4 Install fuses in mounting devices immediately before energizing circuit.

.5 Prior to energization of any circuit, verify that the correct fuse is installed:

.1 for the calculated or assumed circuit capacity, and

.2 for the proper equipment and conductor protection requirements.

3.17 FLOW METER

.1 Install flow meter transmitter (for measurement of sanitary waste leaving the Hub facility) in Mechanical/Electrical Room 200.

.2 Provide lamacoid label on flow meter.

.3 Provide power connection to transmitter.

.4 Provide installation of sensor cable to sensor at manhole. Provide junction box and EYS seals on conduit at manhole.

.5 Provide setup and calibration/paramaterization of the flow meter. Demonstrate setup and operation to Owner.

.6 Coordinate installation with Divisions 22 and 33.

3.18 LIQUID LEVEL MONITOR/CONTROLLER

.1 Install liquid level monitor/controller in Mechanical/Electrical Room 200. Install transducer in the potable water cistern.

.2 Provide lamacoid label on monitor/controller.

.3 Provide power connection to monitor/controller.

.4 Provide installation of instrumentation cable to transducer at cistern. Provide junction box at cistern for interconnection with transducer cable.

.5 Provide interconnection of the monitor/controller with the well pump starter (for start/stop control of the well pump and filling of the cistern).

.6 Provide setup and calibration/paramaterization of the monitor/controller. Demonstrate setup and operation to Owner.

.7 Coordinate installation with Divisions 22 and 33.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

1.3 SCOPE

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00, General Electrical Requirements and the requirements of Division 1.

2 Products

2.1 GROUND CONDUCTORS

.1 Copper conductors, soft drawn, ASTM Class B stranded.

.2 Insulated or bare conductors. Insulation colour green.

2.2 BURIED CONNECTORS - COMPRESSION TYPE

.1 Cable to rod and cable to cable.

.2 Acceptable Manufacturers:

.1 Burndy type YGHR (cable to rod) and type YGHC (cable to cable)

2.3 CONNECTIONS TO STRUCTURAL STEEL

.1 Exothermic connection or compression ground connector.

.2 Acceptable Manufacturers:

.1 Erico (exothermic)

.2 Burndy Groundlink type YGIB and cable connector

2.4 MISCELLANEOUS HARDWARE

.1 Galvanized steel ground studs, bolts, washers, nuts and accessories necessary for grounding system, including but not limited to:

.1 Grounding and bonding bushings

.2 Bolt type conductor connectors

.3 Bonding jumpers, straps

.4 Pressure type wire connectors

.2 Acceptable Manufacturers:

.1 Burndy

.2 T & B Blackburn

2.5 GROUND RODS

.1 Copper-clad steel, minimum 19 mm diameter, 3 m long.

.2 Acceptable Manufacturers:

.1 Hydel

.2 T & B Blackburn

2.6 GROUND BUS

.1 Ground bus: copper, 50 mm x 6 mm thick complete with insulated supports, fastenings, connectors, length as indicated.

2.7 ALUMINUM STRUCTURES AND EQUIPMENT

.1 Use tin or silver plated connectors for grounding connections to aluminum structures and equipment.

.2 Acceptable Manufacturers:

.1 Burndy

.2 Thomas & Betts

3 Execution

3.1 GENERAL

.1 Clean all paint, rust and dirt from all surfaces to which ground lugs are bolted.

.2 Protect exposed grounding conductors from mechanical damage.

.3 Ensure that molds, for exothermic type connections, are not used for more than 50 connections.

.4 At junction and terminal boxes, bond grounding conductors to ground stud.

.5 Bond the main service incomer neutral to service grounding per (three ground electrodes). Supply bonding conductor to the main water supply pipe on the street side of main water valve and meter using plated copper ground strap bolted to pipe flange or welded bracket.

.6 Bond building structural steel elements to ground.

.7 Bond metallic components of electrically operated plumbing devices in the washrooms (flush valves, sink valve actuators, sink enclosed hand dryers and soap dispenser) to ground. All bonding extensions to be concealed and installed per plumbing equipment manufacturer recommendations.

3.2 BURIED GROUNDING

.1 For buried grounding use compression connection types.

3.3 CABLES

.1 Bond single conductor cable armour to equipment enclosure at supply end.

.2 Bond multi-conductor cable armour to equipment enclosures.

.3 Bond grounding conductor of multi-conductor armoured and non-armoured cable to ground bus or lug in equipment enclosures.

3.4 DUCT BANKS

.1 Bond metal raceway within duct banks to system ground.

.2 Connect grounding conductor in duct banks to ground bus or ground rods in electrical rooms, substations, manholes, etc.

3.5 MANHOLES

.1 Provide ground rod(s) in each manhole and connect to metalwork such as, ladder, cable racks, manhole cover frame.

.2 Install ground rod with top projecting through floor slab and install a screw down lug for connection of portable appliances etc.

.3 Where more than one compartment is provided, install ground rod in each compartment.

3.6 ELECTRICAL ROOMS

.1 Install a copper ground bus mounted on stand-off supports on walls of electrical rooms. Connect electrical panels and equipment ground buses and lugs to electrical room perimeter ground bus. Make connections to bus with cable lugs, bolted through the copper bus with shake-proof lock washers and nuts. Use minimum No. 2/0 AWG bare copper conductor to bond ground bus to grounding system.

3.7 RACEWAYS

.1 On raceways, lock-up tight all couplers and connections to boxes and enclosures. Install bonding jumpers at expansion joints, and where necessary. Maintain ground continuity throughout run of raceway.

.2 Install bonding jumpers on both ends of flexible conduit. Use grounding bushing, solderless lug, clamp or cup washer and screw connection. Install grounding conductor inside flexible conduit.

.3 EMT and non-metallic raceways: install insulated grounding conductor in raceway.

.4 Branch and feeder circuits in rigid conduit: use raceway as bonding conductor.

3.8 TELECOMMUNICATION PANEL

.1 Bond metallic raceways to building ground.

.2 Provide No. 6 AWG insulated grounding conductor from telecommunication panel ground lug to ground bus.

3.9 TESTING

.1 Refer to Section 26 05 05 section 2.6; subsection 4, for details on grounding tests.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Work – Division 01.

.2 Concrete – Division 03.

.3 General Electrical Requirements - Section 26 05 00.

1.3 REFERENCES

.1 Ontario Electrical Safety Code.

.2 Local Utility Standards and/or Guidelines.

1.4 SCOPE

.1 Provide all excavation, fill, and backfill, including repair/restoration of existing surfaces (i.e. pavement, sod, concrete, etc.), as required for the installation of underground services and underground feeders, as outlined on the drawings.

.2 Provide underground ducts, duct banks, pulling pits and cables as detailed on drawings.

.3 Provide interconnection of electrical incomer service per specifications.

.4 Provide concrete pedestal base and metering and distribution cabinet for parking area service. Provide metering section per utility company standards and specifications.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 General Electrical Requirements and the requirements of Division 01.

2 Products

2.1 MATERIAL

.1 All material shall be specification grade, new and carry CSA approval.

.2 All ducts, cables and miscellaneous materials required shall be the responsibility of this contractor.

.3 Concrete used (for encasement of ducts) shall have a minimum strength of 2500 psi (15 MPA) and the aggregate used in the concrete should be small enough (9.5mm) to allow to flow freely around ducts.

3 Execution

3.1 GENERAL

.1 Coordinate work with local utilities; obtain underground service locates prior to start of work.

.2 Seal and drain all underground ducts in accordance with Section 22 of the Ontario Electrical Safety Code.

.3 Use bell ends at duct terminations.

.4 Unless noted otherwise on drawings:

.1 All underground ducts shall be surrounded in 6" (150 mm) of sand in non-vehicular areas.

.2 All underground ducts shall be encased 75mm (3") of concrete where ducts pass under vehicular areas.

3.2 TRENCHING

.1 The width and depth of the trench shall be such as to allow room for a 75 mm sand or concrete envelope (as required) around the duct bank and allow sufficient cover.

.2 The bottom of the trench must be graded evenly and the soil in the bottom of the trench must be undisturbed. Overbreak must be filled with compacted granular material or concrete. Ensure that no water traps are formed in individual ducts.

.3 Ensure that the ducts are properly plugged prior to backfilling or concrete encasement.

3.3 DIRECT BURIAL OF CABLES

.1 After sand bed is in place, lay cables maintaining 75mm (3”) clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150mm (6”) for each 60m (200’) run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices are not acceptable.

.4 Cable separation:

.1 Maintain 75mm (3”) minimum separation between cables of different circuits.

.2 Maintain 305mm (12”) horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 305mm (12”) vertical separation with low voltage cables in upper position.

.4 Maintain 305mm (12”) minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.

.5 Install treated planks on lower cables 610mm (2’) in each direction at crossings.

3.4 CONCRETE ENCASED DUCT BANK

.1 Erect a self-supporting structure with the ducts in position before pouring the concrete. Use spacers to establish required vertical and horizontal separation in the duct assembly. Provide reinforcing bars as detailed on drawings.

.2 Concrete shall not be poured when the temperature is below freezing without special precautions. If concrete is poured in freezing weather, heated aggregates and non-corrosive additives shall be used. After pouring, the concrete shall be covered.

.3 To prevent any displacement of the duct structure during pouring, the concrete shall be deflected down alongside the structure to the bottom and up through the assembly.

.4 Concrete shall be poured into the trench until the top layer of ducts is covered to a minimum depth of 75 mm. Chutes should be used when pouring so that the aggregate does not separate. Concrete must not be allowed to freefall more than 3'-0".

.5 The end of the duct structure shall be properly blocked and supported so that a smooth face is attained and no concrete enters the mouth of the ducts.

.6 Warning tape shall be placed approximately midway between top of ductbank structure and finished grade to avoid future damage or injury.

3.5 CLEANING DUCTS

.1 Clean completed duct runs by pulling an approved cleaning device through the ducts by means of a winch line. Tail the cleaning device with a second winch line to permit withdrawal in case of blockage. Clean the ducts in the presence of Consultant or authorized representative.

.2 Provide a polypropylene rope 6 mm in diameter in each duct for future pulling of cables.

.3 At ends of the ductbank plug the ducts and mark the duct bank location.

3.6 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.7 MARKERS

.1 Install marking tape (4-mil polyethylene) buried approximately halfway between grade level and the ducts/cables. Marking tape shall be installed over the complete width and length of duct/cable run.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 General Electrical Requirements.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation of service entrance cables and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.

.5 After installing cable but before terminating, perform insulation resistance test with 1000V megger on each phase conductor.

.6 Resistance to ground of circuits shall be not less than 50 megohm. Remove and replace entire length of cable if cable fails to meet test criteria.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00

.2 Basic Materials and Methods – Section 26 05 05

.3 Lighting – Section 26 50 00

1.3 REFERENCES

.1 American National Standards / Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

.2 Underwriter Laboratories of Canada (ULC)

.3 International Electro-technical Commission

.4 International Organization for Standardization (ISO)

.5 National Electrical Manufacturers Association (NEMA)

.6 WD1 (R2005) - General Color Requirements for Wiring Devices.

.7 Underwriters Laboratories, Inc. (UL)

.1 916 – Energy Management Equipment.

.2 924 – Emergency Lighting

1.4 SYSTEM DESCRIPTION

.1 The Lighting Control and Automation system as defined under this section covers the following equipment:

.1 Digital Room Controllers – Self-configuring, digitally addressable one, two or three relays controllers with 0-10 volt control for ballasts (if applicable) and single relay application-specific plug load controllers.

.2 Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

.3 Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.

.4 Digital Photo sensors – Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.

.5 Digital Plug Load Controllers – Self-Configuring, digitally addressable one relay controllers, specifically designed and cUL listed for use as a plug load control device.

.6 Isolated Relay Interface- A component of the Digital Lighting Management system that allows for seamless integration with third party devices such as HVAC systems of exhaust fans.

.7 Configuration Tools – Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings. Computer software also customizes room settings.

.8 Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.

.9 Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 General Electrical Requirements and the requirements of Division 1.

.2 Shop drawing submission shall include:

.1 Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).

.2 Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.

.3 Product Data: Catalog sheets, specifications and installation instructions.

.4 Include data for each device which:

.1 Indicates where sensor is proposed to be installed.

.2 Prove that the sensor is suitable for the proposed application.

1.6 WARRANTY

.1 Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

2 Products

2.1 MANUFACTURERS

.1 The basis of design for the lighting controls is WattStopper Digital Lighting Management (DLM).

.2 Alternate Manufacturers

.1 Any proposed substitutions shall be submitted in writing a minimum of 5 working days prior to the tender closing date for review by the consultant. Proposed alternate products must be accompanied by a review of the specification noting compliance on a line-by-line basis. Alternate systems shall not be supplied and/or installed without written acceptance by the Consultant.

.2 The Contractor shall accept responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The Contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted in an alternate color to the Consultant for review and approval prior to rough-in.

2.2 SINGLE/DUAL OR THREE RELAY WALL SWITCH OCCUPANCY SENSORS

.1 Type DW: Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled; WattStopper DW-100, DW-200, DW-103, DW-203.Type: ANN.

2.3 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

.1 Wall or ceiling mounted (to suit installation) dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

.2 Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

.1 Digital calibration and pushbutton programming for the following variables:

.1 Sensitivity – 0-100% in 10% increments

.2 Time delay – 1-30 minutes in 1 minute increments

.3 Test mode – Five second time delay

.4 Detection technology – Dual Technology activation and/or re-activation.

.5 Walk-through mode

.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

.2 One or two RJ-45 port(s) for connection to DLM local network.

.3 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

.4 Device Status LEDs including:

.1 PIR Detection

.2 Ultrasonic detection

.3 Configuration mode

.4 Load binding

.5 Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

.6 Manual override of controlled loads.

.3 Units shall not have any dip switches or potentiometers for field settings.

.4 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

.5 WattStopper product numbers: LMDX, LMDC

2.4 DIGITAL WALL SWITCHES

.1 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. Wall switches shall include the following features:

.1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

.3 Red configuration LED on each switch that blinks to indicate data transmission.

.4 Blue Load/Scene Status LED on each switch button with the following characteristics:

.1 Bi-level LED

.2 Dim locator level indicates power to switch

.3 Bright status level indicates that load or scene is active

.5 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

.2 Two RJ-45 ports for connection to DLM local network.

.3 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

.4 The following switch attributes may be changed or selected using a wireless configuration tool:

.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

.2 Individual button function may be configured to Toggle, On only or Off only.

.3 Individual scenes may be locked to prevent unauthorized change.

.4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

.5 Ramp rate may be adjusted for each dimmer switch.

.6 Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

.5 WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMDM-101.

2.5 HANDHELD REMOTE CONTROLS

.1 .1 Battery-operated handheld switches in 1, 2 and 5 button configuration for remote switching or dimming control. Remote controls shall include the following features:

.1 Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.

.2 Blue LED on each button confirms button press.

.3 Load buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

.4 Inactivity timeout to save battery life.

.2 A wall mount holster and mounting hardware shall be included with each remote control.

.3 WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

2.6 ROOM CONTROLLERS

.1 Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:

.1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

.2 Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

.3 Device Status LEDs to indicate:

.1 Data transmission

.2 Device has power

.3 Status for each load

.4 Configuration status

.4 Quick installation features including:

.1 Standard junction box mounting

.2 Quick low voltage connections using standard RJ-45 patch cable

.5 Plenum rated

.6 Manual override and LED indication for each load

.7 Dual voltage (120/277 VAC, 60 Hz)

.8 Zero cross circuitry for each load.

.2 On/Off Room Controllers shall include:

.1 One, two or three relay configuration

.2 Efficient 150 mA switching power supply

.3 Three RJ-45 DLM local network ports

.4 Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

.1 One relay configuration only

.2 Automatic-ON/OFF configuration

.5 WattStopper product numbers: LMRC-101, LMRC-102, LMPL-101

.3 On/Off/Dimming enhanced Room Controllers shall include:

.1 Real time current monitoring

.2 One, two or three relay configuration

.3 Efficient 250 mA switching power supply

.4 Four RJ-45 DLM local network ports.

.5 One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.

.6 Optional Network Bridge for BACnet MS/TP communications (LMRC-3xx).

.7 The following dimming attributes may be changed or selected using a wireless configuration tool:

.1 Establish preset level for each load from 0-100%

.2 Set high and low trim for each load

.3 Set lamp burn in time for each load up to 100 hours

.8 Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

.1 One relay configuration only

.2 Automatic-ON/OFF configuration

.9 WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMPL-201, LMRC-311, LMRC-312, LMRC-313.

2.7 DIGITAL PLUG LOAD CONTROLLERS

.1 Single Relay Digital Plug Load Controllers shall include the following features:

.1 One 20 Amp relay for on/off control of connected plug loads.

.2 High efficiency 150mA power supply.

.3 cUL Listing for use with plug loads.

.4 Three RJ-45 DLM local network ports.

.1 Single relay configuration only

.2 Automatic ON/OFF configuration.

.5 Wattstopper product number: LMPL-101

2.8 ISOLATED RELAY INTERFACE

.1 Isolated relay interface module shall include the following features:

.1 One single pole, double throw isolated relay with normally open, normally closed, and common outputs.

.2 Two RJ-45 DLM local network ports.

.3 Ability to control HVAC systems or exhaust fans using the occupancy signal of any digital occupancy sensor in the local DLM network.

.4 Wattstopper product number: LMIO-100

2.9 ROOM NETWORK (DLM LOCAL NETWORK)

.1 The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:

.1 Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

.2 Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

.3 Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

.4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.10 CONFIGURATION TOOLS

.1 A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

.2 Features and functionality of the wireless configuration tool shall include:

.1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

.2 High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

.3 Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.

.4 Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.

.5 Temporarily adjust light level of any load(s)on the local network, and incorporate those levels in scene setting.

.6 Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

3 Execution

3.1 INSTALLATION

.1 Do not install equipment until the following conditions can be maintained in spaces to receive equipment:

.1 Ambient temperature: 0° to 40° C (32° to 104° F).

.2 Relative humidity: Maximum 90 percent, non-condensing.

.2 When using wire for connections other than the DLM local network (Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements

.3 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

.4 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

.1 Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.

.5 Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

.1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.

.2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

.3 Load Parameters (e.g. blink warning, etc.)

.6 Re-commissioning – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Consultant / Owner of re-commissioning activity.

3.2 FACTORY COMMISSIONING

.1 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

.2 The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.

.3 Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

1.3 REFERENCES

.1 CSA-C22.2 No. 5 - Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

.2 CSA C22.2 No.29 - Panelboards and Enclosed Panelboards.

.3 CSA C22.2 No.144 - Ground Fault Circuit Interrupters.

.4 Transient Voltage Surge Suppression Devices, Section 26 43 13.

1.4 SCOPE

.1 Provide panelboards complete with moulded case circuit breakers and other accessories as detailed herein and on drawings.

.2 Minimum service entrance panel short circuit ratings to be 10kAIC fully rated. Secondary distribution panels to be 10kAIC, series rating acceptable provided panel and upstream breaker combination meet cUL testing requirements.

.3 Provide transient voltage surge suppression devices for distribution panels and panelboards as detailed on drawings.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00, General Electrical Requirements and the requirements of Division 1.

2 Products

2.1 MATERIAL

.1 All panelboards and moulded case circuit breakers shall be of one manufacturer. Acceptable Manufacturers: Cutler Hammer, Schneider Electric, Siemens.

.2 All material shall be specification grade, new and carry CSA approval or special inspection approval in accordance with the requirements of the Electrical Safety Authority.

2.2 PANELBOARDS

.1 Refer to drawings for specific details pertaining to panelboards: mains rating, voltage, main lug or main breaker, flush or surface mounting, number of circuits, and number and size of branch circuit breakers.

.2 Install circuit breakers in panelboards before shipment.

.3 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.4 120/240VAC panelboards: bus and circuit breakers rated for a minimum 10kA (rms symmetrical) interrupting capacity or as indicated in panel schedules. Main service panel fully rated. Secondary panels may be series rated provided cUL listed for series operation.

.5 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.

.6 Provide two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating as mains. Provide 200% rated neutral.

.8 Mains: suitable for bolt-on circuit breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

.11 Panelboard Accessories: Refer to drawings for details regarding any required panelboard accessories (sub feed lugs, feed through lugs, contactor on mains, etc.).

2.3 MOULDED CASE CIRCUIT BREAKERS

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Circuit breakers for 120/240V panelboards to have minimum 10kA symmetrical rms interrupting capacity rating.

.4 Where series rated circuit breakers are utilized, they shall be manufacturer tested and listed per cUL. Circuit breakers to be applied following manufacturer's guidelines and accepted best practice.

.5 Circuit breakers shall have thermal and magnetic tripping in panelboards except as indicated otherwise. (Circuit breakers rated 90A or more shall have adjustable magnetic setting; circuit breakers rated 250A or more shall have adjustable electronic trip settings).

.6 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.7 Lock-on devices to be provided for exit signs, security system, and telecommunication equipment. Provide additional devices where noted on drawings.

2.4 TRANSIENT VOLTAGE SURGE SUPPRESSION

.1 All panelboards shall be supplied complete with integral transient voltage suppression unit.

.2 Refer to Section 26 43 13, Transient Voltage Surge Suppression.

3 Execution

3.1 PANELBOARDS

.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 a common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 – General Electrical Requirements or as indicated.

.4 Provide a spare 32mm (1¼ ") EMT raceway into accessible ceiling space from each recessed panel. Provide nylon pull string in raceway and cap open end.

.5 Connect loads to circuits. Complete circuit directory with typewritten legend showing location and load of each circuit.

.6 Provide EEMAC 12 enclosure for indoor panelboards.

.7 Provide lamacoid nameplate mechanically fastened to identify each panel. Letter size to be as described in Section 26 05 00.

3.2 CIRCUIT BREAKERS

.1 Ensure all circuit breakers mounted in panelboard have the specified interrupting capacity required for that piece of equipment.

3.3 PANELBOARD TVSS DEVICES

.1 Panel surge suppressors shall be installed within the panelboards at the manufacturer's factory.

.2 A direct bus bar connection shall be used to mount the TVSS component to the panelboard bus bar to reduce the impedance of the shunt path.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

1.3 REFERENCES

.1 CSA C282 Emergency Electrical Power Supply for Buildings

.2 CSA C22.2, No. 14-M91 Industrial Control Equipment

1.4 SCOPE

.1 Provide a propane fuelled standby emergency generator complete with sound attenuated weather enclosure and all ancillary devices as required for a complete and functional system.

.2 Provide an automatic transfer switch for interconnection of the normal power supply and the standby power supply to the building loads.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 General Electrical Requirements and the requirements of Division 1.

1.6 WARRANTY

.1 Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months from registered commissioning and start-up.

.2 Extended Warranty: Manufacturer shall offer extend coverage of 5 years from date of registered commissioning and start-up.

2 Products

2.1 GENERATOR - GENERAL REQUIREMENTS

.1 Generator Ratings

.1 The generator set shall operate at 1800 rpm and at a voltage of: 120/240Volts AC, Single phase, three wire, 60 hertz.

.2 The generator set shall be rated at 80kW, standby rating, based on site conditions of : Altitude 250 meters, ambient temperatures to 35 C (max) and -35C (min).

.3 The generator set rating shall be based on emergency/standby service.

.2 Performance

.1 Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

.2 Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

.3 The engine generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine generator set at operating temperature.

.4 Motor starting capability shall be a minimum of 290kVA. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.

.5 The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

.3 Construction

.1 The engine generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails

.2 All switches, lamps, and meters in the control system shall be oil tight and dust tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

.4 Connections

.1 The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.

.2 Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

.3 Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.2 ENGINE AND ENGINE EQUIPMENT

.1 The engine shall be propane fueled, radiator and fan cooled. Minimum displacement shall be 359 cubic inches (5.9 litre), with 6 cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Engine accessories and features shall include:

.2 Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set. For dual fuel systems, changeover from primary to secondary fuel shall be automatic.

.3 An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

.4 Skid mounted radiator and cooling system rated for full load operation in 104 degrees F (40 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H2O external static head. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact.

.5 Electric starter(s) capable of three complete cranking cycles without overheating.

.6 Positive displacement, mechanical, full pressure, lubrication oil pump.

.7 Full flow lubrication oil filters with replaceable spin on canister elements and dipstick oil level indicator.

.8 Replaceable dry element air cleaner with restriction indicator.

.9 Flexible fuel lines.

.10 Engine mounted battery charging alternator, 40-ampere minimum, and solid state voltage regulator.

.11 Coolant heater

.1 Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.

.2 The coolant heater shall be installed on the engine with high temperature silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

.3 The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.

.4 The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

.12 Provide vibration isolators, spring/pad type or as recommended by the manufacturer, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

.13 Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.

.14 Provide exhaust silencer for engine size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The muffler shall be super critical grade or better, as required to achieve the specified sound attenuation. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

.15 Provide a minimum 12 amp battery charger for each generator set battery bank. Generator sets incorporating two battery banks shall be provided with two chargers connected together and operating in parallel, with alarm output(s) connected in parallel. The charger(s) shall include the following capabilities:

.1 Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications.

.2 The charger shall be compliant with UL991 requirements for vibration resistance.

.3 The charger shall comply with the requirements of EN61000-4-5 for voltage surge resistance; EN50082-2 for immunity; EN61000-4-2 for ESD; EN61000-4-3 for radiated immunity; ANSI/IEEE C62.41 category B and IN61000-4-4 for electrically fast transient; EN61000-4-6 for conducted emissions; and FCC Part 15 Class A for radiated emissions.

.4 The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours.

.5 The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible

recharge after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charge battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.

.6 The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.

.7 The charger shall include the following features:

.1 two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;

.2 LED indicating lamp(s) to indicating normal charging condition (green), equalize charge state (amber), and fault condition (red);

.3 AC input overcurrent, over voltage, and undervoltage protection;

.4 DC output overcurrent protection;

.5 Alarm output relay

.6 Corrosion resistant aluminum enclosure

.8 The battery charger shall be mounted within the generator weather enclosure.

2.3 AC GENERATOR

.1 The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 °C.

.2 The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

.3 A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

.4 The subtransient reactance of the alternator shall not exceed 15 percent, based on the standby rating of the generator set.

2.4 GENERATOR SET CONTROL.

.1 The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

.2 The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

.3 The generator set mounted control shall include the following features and functions:

.1 Control Switches

.1 Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the

generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

.2 EMERGENCY STOP switch. Switch shall be Red "mushroom head" push button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

.3 RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

.4 PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

.2 Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

.1 Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW hours, and power factor. Generator output voltage shall be available in line to line and line to neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

.2 The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

.3 The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

.3 Generator Set Alarm and Status Display.

.1 The generator set control shall include LED alarm and status indication lamps. The lamps shall be high intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

- The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).
- The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
- The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
- The control shall include an amber common warning indication lamp.

.2 The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

- low oil pressure (warning)
- low oil pressure (shutdown)
- oil pressure sender failure (warning)
- low coolant temperature (warning)

- high coolant temperature (warning)
- high coolant temperature (shutdown)
- high oil temperature (warning)
- engine temperature sender failure (warning)
- low coolant level (warning)
- fail to crank (shutdown)
- fail to start/overcrank (shutdown)
- overspeed (shutdown)
- low DC voltage (warning)
- high DC voltage (warning)
- weak battery (warning)
- low fuel daytank (warning)
- high AC voltage (shutdown)
- low AC voltage (shutdown)
- under frequency (shutdown)
- over current (warning)
- over current (shutdown)
- short circuit (shutdown)
- over load (warning)
- emergency stop (shutdown)
- (4) configurable conditions

.3 Provisions shall be made for indication of four customer specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

.4 Engine Status Monitoring.

.1 The following information shall be available from a digital status panel on the generator set control :

- engine oil pressure (psi or kPA)
- engine coolant temperature (degrees F or C)
- engine oil temperature (degrees F or C)
- engine speed (rpm)
- number of hours of operation (hours)
- number of start attempts
- battery voltage (DC volts)

.2 The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

.5 Engine Control Functions.

.1 The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

.2 The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

.3 The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

.4 The control system shall include time delay start (adjustable 0 300 seconds) and time delay stop (adjustable 0 600 seconds) functions.

.5 The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

.6 Alternator Control Functions:

.1 The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

.2 Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.

.3 Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.

.4 Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

.5 A line to neutral sensing AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

.7 Other Control Functions

.1 The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.

.2 A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

.8 Control Interfaces for Remote Monitoring:

.1 The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.

.2 A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

.3 A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

.4 Remote Monitoring System: The generator shall have provisions for remote monitoring via cellular wireless communication. SMS (short message service) texts shall be transmitted via cellular communication for indication of generator alarms or shutdowns.

2.5 CIRCUIT BREAKER

.1 The generator set shall be provided with a mounted main line circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

.2 The generator set shall be provided with a second main line circuit breaker sized to carry the rated output of the generator. The circuit breaker shall be provided for periodic load bank testing of the generator.

2.6 OUTDOOR, SOUND ATTENUATED, WEATHER-PROTECTIVE GENERATOR ENCLOSURE

.1 The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

.2 All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal. All surfaces of all metal parts shall be primed and painted.

.3 Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

.4 Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.

.5 A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

.6 The enclosure shall include the following maintenance provisions:

.1 Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves

.2 External radiator fill provision.

.7 Sound Attenuation:

.1 The generator set shall be provided with a sound-attenuated housing which allows the generator set to operate at full rated load in an ambient temperature of up to 100F. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 75dBA at any location 7 meters from the generator set in a free field environment.

.2 The enclosure shall be insulated with non-hydroscopic materials.

.8 Additional Features:

.1 Provide motorized louvers to minimize air flow through the enclosure when generator set is not operating. Louvers shall include provisions to prevent accumulation of ice or snow that might prevent operation.

.2 Inlet ducts shall include rain hoods.

.3 Provide a factory mounted and wired electrical distribution panel to serve the generator set and enclosure. The provisions required include:

.4 100-amp distribution panelboard connected to a 120/240VAC utility service by the installer.

.5 One duplex GFI receptacle inside the enclosure.

.6 Two three-way switches controlling three AC lamps mounted in vapor tight and gasketed fixtures.

.7 Factory-wired normal AC service from the panelboard to the engine coolant and alternator heaters, and battery charger.

2.7 AUTOMATIC TRANSFER SWITCH – GENERAL REQUIREMENTS

.1 Provide transfer switch in the number and ratings that are shown on the drawings.

.2 Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.

.3 Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).

.4 Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

.5 Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).

.6 Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

.1 Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.

.2 Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.

.3 Main switch contacts shall be high pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.

.4 Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.

.5 The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.

.6 The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.

.7 Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.

.8 The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.

.1 Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality

.7 Control: Transfer switch control shall be capable of communicating with the genset control, other switches and remote programming devices over a high-speed network interface.

.8 Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism

.9 Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer's discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.

.10 Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:

.1 Exterior cabinet doors shall provide complete protection for the system's internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.

.2 Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.

.1 Transfer switches located outdoors shall be supplied in NEMA Type 3R (IEC IP34) when dust-proof and/or rain-proof enclosures are required.

2.8 AUTOMATIC TRANSFER SWITCH

.1 Comply with requirements of CSA C282.

.2 Indicated current ratings:

.1 Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.

.2 Main contacts shall be rated for 250 VAC minimum.

.3 Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non condensing), and altitudes up to 10,000 feet (3000 meters).

.3 Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function

.4 Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project..

.5 Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high speed control network.

.6 Transfer switch shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

.7 Automatic Transfer Switch Control Features

.1 The transfer switch control system shall be configurable in the field for any operating voltage level up to 250 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.

.2 All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.

.3 The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.

.4 The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.

.5 The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.

.6 The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.

.7 The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

.8 The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when

both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.

.8 Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.

.1 The indicator panel LEDs shall display:

.1 Which source the load is connected to (Source 1 or Source 2)

.2 Which source or sources are available

.3 When switch is not set for automatic operation, because the control is disabled or the bypass switch is in use

.4 When the switch is in test/exercise mode

.2 The indicator shall have pushbuttons that allow the operator to activate the following functions:

.1 Activate pre-programmed test sequence

.2 Override programmed delays, and immediately go to the next operation

.3 Reset the control by clearing any faults

.4 Test all of the LEDs by lighting them simultaneously

.3 The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:

.1 AC voltage for all phases, normal and emergency

.2 Source status: connected or not connected.

.3 Load data, including voltage, AC current, frequency, KW, KVA, and power factor.

.4 The display panel shall be password-protected, and allow the operator to view and make adjustments:

.1 Set nominal voltage and frequency for the transfer switch

.2 Adjust voltage and frequency sensor operation set points

.3 Set up time clock functions

.4 Set up load sequence functions

.5 Enable or disable control functions including program transition

.6 View real-time clock data, operation log (hours connected, times transferred, failures) and service history

.9 Control Functions: Functions managed by the control shall include:

.1 Software adjustable time delays:

.1 Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)

.2 Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)

.3 Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)

.4 Engine cooldown: 0 to 30 minutes (default 10 min)

.5 Programmed transition: 0 to 60 seconds (default 3 sec)

.2 Undervoltage sensing: three-phase normal, three-phase emergency source.

.1 Pickup: 85 to 98% of nominal voltage (default 90%)

.2 Dropout: 75 to 98% of nominal voltage (default 90%)

.3 Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)

.4 Accurate to within +/- 1% of nominal voltage

.3 Over-voltage sensing: three-phase normal, three-phase emergency source.

.1 Pickup: 95 to 99% of dropout setting (default 95%)

.2 Dropout: 105 to 135% of nominal voltage (default 110%)

.3 Dropout time delay: 0.5 to 120 seconds (default 3 sec)

.4 Accurate to within +/- 1% of nominal voltage

.4 Over/under frequency sensing:

.1 Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)

.2 Dropout: +/-1% beyond pickup (default 1%)

.3 Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)

.4 Accurate to within +/- 0.2%

.5 Voltage imbalance sensing:

.1 Dropout: 2 to 10% (default 4%)

.2 Pickup: 90% of dropout

.3 Time delay: 2.0 to 20 seconds (default 5 sec)

.6 Phase rotation sensing:

.1 Time delay: 100 msec

.7 Loss of single-phase detection:

.1 Time delay: 100 msec

.10 Control features shall include:

.1 Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.

.1 Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.

.2 In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.

.3 The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.

.4 Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

.11 Control Interface

.1 Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

.2 The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.

.3 Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

.12 Engine Starting Contacts

.1 One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

3 Execution

3.1 FACTORY TESTING

.1 The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

.2 Factory testing may be witnessed by the Owner and/or Engineer. Costs for travel expenses will be the responsibility of the Owner. Supplier is responsible to provide two weeks notice for factory testing.

.3 Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady state governing, single step load pickup, and function of safety shutdowns.

3.2 INSTALLATION

.1 Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with CSA C282 requirements.

.2 Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable provincial and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling.

.3 Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

.4 Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

.5 Equipment shall be initially started and operated by representatives of the manufacturer.

.6 All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

3.3 ON SITE ACCEPTANCE TEST

.1 The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

.2 Installation acceptance tests to be conducted on site and shall be in accordance with the requirements of CAN/CSA C282. Provide a load bank and make temporary connections for full load test.

3.4 DEMONSTRATION AND TRAINING

.1 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

.2 The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the Owner.

3.5 SERVICE AGREEMENT:

.1 The supplier shall include in the base price, a one-year service agreement. The maintenance shall be performed by factory authorized service technicians capable of servicing both the engine generator set and the transfer switch. This agreement shall include the following:

.1 Generator supplier must have an in-house rental fleet with equipment sized to back up this project site.

.2 All engine maintenance as recommended by the service manual.

.3 All electrical controls maintenance and calibrations as recommended by the manufacturer.

.4 All auxiliary equipment as a part of the emergency systems.

.5 The supplier shall guarantee emergency service.

.6 All expendable maintenance items are to be included in this agreement.

.2 A copy of this agreement and a schedule shall be given to the Owner at the time of his acceptance, showing what work is to be accomplished and when.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

.2 Panelboards and Circuit Breakers – Section 26 24 16.01

1.3 REFERENCES

.1 Underwriters Laboratories UL 1283 and UL 1449 (3rd edition)

.2 Underwriters Laboratories Canada

.3 Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)

.4 American National Standards Institute

.5 Canadian Standards Association

1.4 SCOPE

.1 Provide transient voltage surge suppression device for service entrance and panelboards as detailed on drawings.

.2 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy transient voltage surge suppressors. The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C environments (as tested by ANSI/IEEE C62).

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00, General Electrical Requirements and Division 1 requirements.

1.6 WARRANTY & QUALITY ASSURANCE

.1 The panel mounted surge protection device (SPD) and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of thirty (30) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Additionally, during the applicable warranty period, any SPD which fails due to any electrical anomaly, including lightning, shall be repaired or replaced by the manufacturer without charge. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

2 Products

2.1 MATERIAL

.1 Transient voltage suppression units shall be identical manufacture and compatible with panelboard. Alternate manufacturers shall not be substituted unless written acceptance is obtained prior to tender close (refer to section 26 05 00).

.2 All equipment shall be new and carry CSA approval.

2.2 GENERAL

.1 The SPD shall be listed by ETL, UL, or other nationally recognized test laboratory to UL's 1283 and UL's 1449 standards (3rd edition, latest revision), and not merely the components or modules. All SPD's shall be Type 1 for use in Type 1 and Type 2 locations.

.2 The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-

neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable.

.3 Obtain all surge suppression devices through one source from a single manufacturer.

.4 The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems

.5 All SPD's shall be equipped with a comprehensive monitoring system which shall include a visual display providing information on unit status and phase loss/protection loss.

.6 If a disconnect switch is specified, the disconnect switch and the SPD as a system shall be capable of interrupting up to a 200kA symmetrical fault current with 600 VAC applied.

.7 Each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing at an independent, nationally recognized test laboratory. To be considered for approval, the manufacturer must submit a test report on a unit which was tested with internal over current fusing in place. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 µsec 6000V open circuit voltage waveform and an 8 X 20 µsec 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 µsec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Compliance is achieved if the suppression voltage found from the two UL1449 surges does not vary by more than +10%. Test data on an individual module is not acceptable.

3 Execution

3.1 INSTALLATION

.1 Install the SPD's with the conductors as short and straight as practically possible.

.2 Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

.3 Main service entrance units shall be installed on a 60 amp breaker or, where indicated, shall be installed on a fused disconnect switch that meets or exceeds the fault current rating of the service entrance equipment.

.4 Branch panel units shall be installed on 30 amp dedicated circuit breakers (or fused disconnect switch).

.5 The installing contractor shall comply with all applicable codes.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

1.3 REFERENCES

.1 C22.2 No. 250.0 – Luminaires.

.2 C22.2 No. 9.0 - General Requirements for Luminaires.

1.4 SCOPE

.1 Provide lighting fixtures (luminaires) complete with LED light sources, drivers and accessories as detailed herein and in the lighting fixture schedule (on drawings).

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00, General Electrical Requirements and the requirements of Division 1.

1.6 WARRANTY

.1 All LED lighting fixtures shall be supplied with a minimum of five years' warranty.

2 Products

2.1 MATERIAL

.1 All material shall be specification grade, where applicable, new and carry CSA approval or special certification as per Electrical Safety Authority requirements.

.2 Similar devices and items shall be from one manufacturer throughout the project.

.3 LED light sources and integrated electronic drivers detailed in this specification are based on manufacturers listed in the fixture schedule. Alternate products will also be acceptable subject to equivalent performance and conformance with the specifications.

.4 Refer to Lighting Fixture Schedule on drawings for details of fixtures to be supplied. Where alternate fixtures are proposed, provide submission prior to tender close in accordance with Section 26 05 00.

2.2 LED LAMPS

.1 Remote phosphor technology providing increased efficiency and color consistency. Color shift shall not exceed +/- 100K over life of lamp.

.2 Rated Life: Based on IESNA LM-80-2008

50,000 hours at 70% lumen maintenance.

.3 LED drivers shall provide 0-10V dimming where required; refer to fixture schedule on drawings for fixtures to be dimmed.

.4 Warranty: 5 years

2.3 FIXTURE CONSTRUCTION

.1 All interior fixtures shall comply with CSA Standard C22.2 No.9, latest edition, complete with accessories and components, complying with relevant CSA standards applicable to accessory or component.

.2 Fixture lens, where specified, shall be flat and in hinged metal frame unless otherwise specified, made from clear acrylic lenses and shall be 100% virgin acrylic minimum 3.2mm (.125") thick.

.3 Standard fixture colour shall be baked white enamel unless noted otherwise, which shall resist chipping, corrosion and discolouration. Before finishing all metal shall be chemically degreased and neutralized. Where custom fixture colours are required, colour shall be confirmed via shop drawing submission.

.4 All fixtures shall be CSA approved and/or carry certification by a certifying organization recognized by the Electrical Safety Authority.

3 Execution

3.1 INSTALLATION

.1 Co-ordinate fixture locations with other trades on site prior to rough in.

.2 Install fixtures complete with all mounting hardware and trims for a neat, finished appearance.

.3 Ensure that all fixtures installed in built-in enclosures can be serviced for lamp changing, ballast changing, etc.

3.2 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.3 LUMINAIRE SUPPORTS

.1 General:

.1 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment, and in a horizontal or vertical position as intended.

.2 Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.

.3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.2 Supports:

.1 Self-alignment ball joint hangers shall be used for rod suspended fixtures, and ceiling canopies shall be fitted tightly to the ceiling without restricting the alignment of the hanger.

.2 Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted, or prevent complete alignment of several fixtures in a row.

.3 Mounting methods for fixtures on or in suspended ceilings are to be as follows:

.1 Secure surface mounted equipment with twist clip fasteners to inverted 'T' bar ceilings and independently support clips using jack chain to structure above.

.2 Where cross member supports are required above the ceiling to provide support points, these are to be steel channels or angles.

.3 Toggle bolts of the Snap-On or spring-in type are not to be used through drywall, tile or similar type ceilings.

.4 Lay-in or recessed luminaires (or luminaires mounted to the lower surface of suspended ceilings) shall be secured to the building structure. Each fixture shall be secured at opposite ends by a minimum of No. 12 AWG (2.70mm) galvanized soft annealed, mild steel wire (pencil rod) or fixture chain of adequate strength.

.3 Suspension Length:

.1 The suspension length for all ceiling-mounted, suspended types of lighting fixtures, as listed in the Fixture Schedule, shall be the overall length from the ceiling to the lowest point of the fixture body, reflector, or glassware in its hanging position.

.2 The length of the stems or chain hangers of suspended fluorescent lighting fixtures shall be adjusted to hang all fixture bodies in the same room level and in the same horizontal plane, unless specifically required to be otherwise on the electrical drawings.

.4 Chain Hangers:

.1 Where fixtures are specified to be chain hung, the chain used shall be No. 4 Tensile bright zinc coated with a strength of 181 kg. Attachments shall be made using No. 105 'S' hooks. Wires running down chain to fixture shall be run in flexible conduit and shall be attached to chain with cable clips.

3.4 WIRING

.1 Connect luminaires to lighting circuits as detailed on drawings.

.2 Refer to Section 26 05 05, Basic Materials and Methods for acceptable wiring methods.

3.5 CLEANING

.1 Immediately prior to completion of project, provide a final cleaning of fixtures in accordance with Section 26 05 00 and Division 1.

3.6 SPARE FIXTURES

.1 Supply the specified spare fixtures in labeled cartons, identifying wattage and fixture reference.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

1.3 REFERENCES

.1 CSA C22.2 No.141-10 - Emergency Lighting Equipment.

.2 CAN/CSA C860-11 - Performance of Internally Lighted Exit Signs.

.3 OESC Section 46 - Emergency Power Supply, Unit Equipment, Exit Signs and Life Safety Systems.

1.4 SCOPE

.1 Provide a complete and operational emergency lighting and exit sign system capable of operating (upon loss of normal power) for a minimum of 30 minutes under full load conditions.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 General Electrical Requirements and the requirements of Division 1.

1.6 WARRANTY

.1 Emergency lighting equipment units shall be fully warranted to be free of defects in material and workmanship under normal use for a period of one (1) year.

.2 Emergency lighting unit equipment batteries shall be warranted to be free of defects in material and workmanship under normal use for a period of one (1) year full and nine (9) years Pro Rata.

.3 LED lamps used in Exit signs shall be warranted to be free of defects in material and workmanship under normal use for a period of ten (10) years.

.4 The full warranty period shall begin on the date of substantial completion of the project.

2 Products

2.1 INDIVIDUAL EMERGENCY LIGHTING UNITS:

.1 Performance: In accordance with CSA 22.2-141.

.2 Design: Individually packaged battery powered units, with one or more integral and remote sealed beam lamps mounted for horizontal and vertical adjustment.

.3 Batteries: 12 volt, sealed pure lead design, suitable for –20°C to 40°C ambient, with minimum capacity for carrying lamp loads plus 25 percent spare capacity (minimum 50 watts total) for one hour (based on ambient of 20°C), rechargeable, maintenance free type, with high impact material container.

.4 Battery Charger: Solid state, automatic, two rate with capacity to restore battery to full charge within 12 hours following one hour full rate discharge.

.5 Solid State Switching: Automatically connect lamps to battery upon failure of 120 V AC power or when supply voltage drops below 90 V. Supply a sealed type transfer relay and a low battery voltage disconnect circuit. Include a time delay where noted on the Luminaire Schedule.

.6 Accessories: Test switch and LED pilot lights to indicate when battery being charged and when battery fully charged.

.7 Lamps: See the Luminaire Schedule.

.8 Enclosure type as per the Luminaire Schedule.

.9 Include 1220 mm long, three wire cord with U ground, twist-lock plug for connection to receptacle outlet. Coordinate plug and receptacle type and location to suit.

2.2 EMERGENCY LIGHTING AND EXIT SIGNS:

.1 Approved Manufacturers:

.1 Lumacell, or

.2 EmergiLite, or

.3 Approved Equivalent

.2 Refer to the Lighting Fixture Schedule on the Drawings.

.3 Fixture: UV stabilized polycarbonate, with universal mounting bracket (wall, end or ceiling), integral solid-state battery charger, low battery voltage disconnect and load transfer for operation on 120 volts AC.

.4 Battery: Sealed NI-CAD type, minimum one hour capacity (20°C ambient), 10 year maintenance free design.

.5 Features: LED type lamps, test switch, rate of charge indicating LED light and low battery voltage disconnect and warning LED light.

.6 Exit Signs: Illuminated, with pictogram style, single or double face as required. Directional arrow as required.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with the manufacturer’s recommendations.

.2 Where required, provide proper hangers, pendants, and canopies as necessary for complete installation.

.3 Install plumb and level, parallel or perpendicular to building lines.

3.2 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

.1 Install in accordance with the manufacturer’s recommendations.

.2 Provide integral and remote heads as specified and indicated in the Contract Documents.

.3 Provide permanent circuit connections to receptacle at high level, with conduit and wire.

.4 Connect emergency lighting to branch circuits that also feed area lighting. Exit signs shall be on dedicated circuits.

.5 Install exit signs at locations indicated in the Contract Documents and as required. Install exit signs wall mounted 300 mm above doorway openings unless indicated otherwise on drawings. Coordinate installation with process equipment to ensure signage is visible.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

.2 Intrusion Detection – Section 28 16 00.

.3 Video Surveillance – Section 28 23 00.

1.3 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 214-[02], Communications Cables (Bi-National standard with UL 444).

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-568-B.1-(2001), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.

.3 TIA/EIA-568-B.2-(2001), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.

.4 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.

1.4 SCOPE

.1 Structured telecommunications wiring system consist of unshielded-twisted-pair cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for telecommunications systems, including security and video.

.2 Installed in physical star configuration.

.1 Horizontal cables link CCTV equipment (cameras) to head end equipment.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00, General Electrical Requirements and the requirements of Division 1.

2 Products

2.1 FOUR-PAIR, UNSHIELDED, TWISTED PAIR CABLE

.1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT4 to: CSA-C22.2 No. 214, Category 6 (Cat 6) to: TIA/EIA-568-B.2.

.2 Cables installed in underground ducts shall be gel filled type, suitable for wet location installation.

2.2 MULTI-CONDUCTOR SECURITY CABLE

.1 Two conductor, 18awg, PVC insulated, PVC jacketed cables for connection of intrusion alarm door contacts.

.2 Cables installed in underground ducts shall be water blocked type, suitable for wet location installation.

.3 Confirm required cable specifications with equipment manufacturer.

2.3 TERMINATION AND CROSS-CONNECTION HARDWARE FOR UTP CABLE

.1 Patch panel, 24 port.

.1 Each port equipped with factory installed "RJ-45" jacks, Category 6 to: TIA/EIA-568-B.2.

.2 Horizontal cable-management unit for every 24 ports.

2.4 UTP PATCH CORDS

.1 Factory-installed male plug on each end to mate with "RJ-45" jack to: TIA/EIA-568-B.2. Category 6, 4 pairs. 1.2m length.

3 Execution

3.1 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install horizontal cables as indicated in conduits from telecommunication rooms to equipment locations. Identify and label as indicated to: TIA/EIA-606-A.

.1 Identify and label as indicated to: TIA/EIA-606-A.

.2 Terminate horizontal cables in telecommunications room and at equipment locations.

.1 Identify and label as indicated to: TIA/EIA-606-A.

.3 Harness slack cable in cabinets, racks, and wall-mounted termination and cross-connection hardware.

.4 Cables installed to surveillance and intrusion detection devices shall be concealed from public access.

3.2 IMPLEMENT CROSS-CONNECTIONS

.1 Implement cross-connections using patch cords as specified.

3.3 FIELD QUALITY CONTROL

.1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as hard copy and electronic record on USB thumb drive.

.1 Perform tests for Channel on 20% of cross-connected data horizontal cabling installed from each telecommunications room, including shortest and longest drops from each telecommunications room: should more than 5% of tested cables fail, test remaining cross-connected data cables.

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00

.2 Structured Cabling for Communications Systems - Section 27 10 05.

.3 Video Surveillance - Section 28 23 00.

1.3 SCOPE

.1 Labour, products, equipment and services necessary to provide a complete and functional intrusion detection system including but not limited to the following:

.1 Control Panel (with expansion modules for additional input capacity as required)

.2 Key Pads

.3 Door Contacts

.4 Cellular Communication

.5 Power Supply

.6 Enclosure (with lock and tamper switch)

.7 Wiring and Conduits.

1.4 SYSTEM DESCRIPTION

.1 A functionally complete, integrated Digital Alarm Communicator System (DACS) per manufacturer's guidelines, codes and specification requirements.

.2 The DACS Control Panel shall include:

.1 Recording and retention of event information in a dedicated event log.

.2 An integral real-time clock, calendar, and a test timer.

.3 A time / event-based scheduling system.

.4 Supervision of peripheral devices and communications interfaces.

.5 Configuration and operation of separate, independent areas.

.6 Hard-wired or wireless point expansion via eight-point interface modules and RF receivers.

.7 Addressable expansion utilizing a 2-wire bus

.8 Removable terminal strips for wiring connection to facilitate simple service and replacement

.9 Electrically supervised detection loops and power supplies with battery(s) maintenance. This supervision shall be programmable for the purposes of reporting this information to the DACR.

.10 Test, diagnostics, and configuration programming functions locally or remotely via a portable programmer or a computer running the Remote Programming Software (RPS).

.11 Annunciation of alarm, trouble, service reminders, and other relevant system status messages.

.3 The system shall be monitored via cellular communication; no other communication services will be available at the installation site.

.4 Backup power to the system shall be provided by UPS (refer to Section 28 23 00) and standby generator.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00, General Electrical Requirements and the requirements of Division 1.

1.6 WARRANTY

.1 Manufacture shall provide a three (3) year replacement warranty on all intrusion detection system equipment.

2 Products

2.1 CONTROL PANEL AND FEATURES:

.1 The DACS control panel shall be Bosch model B9512G (or approved equivalent) comprising a fully integrated intrusion control system.

.2 The control panel shall support the following:

.1 The DACS system is capable of being utilized as a combination Intrusion and Commercial Fire system per code. Fully integrated intrusion and fire functions allow users to interface with 1 system instead of 2

.2 Integrated Conettix IP based communication provides high-speed, secure alarm transport and control.

.3 32 programmable areas with perimeter and interior partitioning.

.4 8 on-board, hardwired points with expansion capability for a total of 599 using a combination of wired or wireless points.

.5 Compatibility with Color Graphic Touch Screen, 2-line alpha numeric capacitive touch, ATM style LCD or 2-line LCD style Alarm Keypads.

.6 Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).

.7 The system shall include an integrated USB port for local programming and diagnostics using a computer running Remote Programming Software (RPS) and a male USB2.0 to male USB 2.0 cable with no additional hardware modules required.

.8 The system shall support the use of an Apple iOS device and/or Android device for control. Functions to include arming, disarming and control of outputs and access door, viewing of connected IP cameras. This application shall connect directly to the DACS using internet, wifi or cellular communications and shall not require a third party server of network operations center (noc).

.9 The DACS will allow integration with up to 16 Bosch IP video cameras using the built-in Ethernet connection, allowing the cameras to act as inputs and outputs.

.10 The DACS shall support integration with the Bosch Video Management System (BVMS) using the built-in Ethernet adapter.

.11 The DACS shall support up to thirty-two (32) custom functions allowing the installer to combine up to 6 functions into one command. These custom functions shall be operated by keypad command, point activation, keyfob button, or programmable schedule

.12 The DACS shall support up to 32 keypad shortcuts which allow the installer to define which commands are available at each keypad.

.13 The system shall offer multiple language support that can be assigned per keypad. Languages supported must include English and French.

.14 The DACS shall support flash firmware upgrades of systems firmware for the control panel and peripherals, allowing for future updates.

.15 Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.

.16 3 configurable form ‘C’ wet or dry-contact relay outputs with expansion capability for up to an additional 472 dry-contact relay outputs.

.17 Supervision of peripheral devices and communications interface(s).

.3 Point Functionality and Expansion:

.1 Each point in the system shall be programmable to provide the following type of response in the system:

.1 Always on (24 hour response).

.2 On when the system is Master Armed.

.3 Only on when the system is Perimeter Armed.

.4 Displays / Does Not Display at the ACC when the point is activated.

.5 Provides / Does Not Provide entry warning tone.

.6 Sounds / Does Not Sound audible alarm indication.

.7 The Point is bypassable / not bypassable.

.8 Alarm Verification with programmable verification time.

.9 Relay activation by Point.

.10 Provides / Does Not Provide "watch point" capability.

.11 Provides Swinger Bypass.

.12 Defers Bypass Report.

.13 Can return to the system after being force armed and then restoring.

.14 Can return to the system after being bypassed and then restoring.

.15 Keyswitch arming (maintained or momentary)

.16 Activate by Custom Function

.17 Activate following an output

.4 Output Relay Expansion: The DACS shall provide the capability for output relay expansion using relay expansion modules. Independent control of relay functions by area shall be possible through programming assignments.

.1 The DACS shall be capable of activating 472 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module

.2 The DACS shall be capable of activating 64 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module

.3 The DACS shall be capable of controlling relays and automatically executing system functions based on a time / event scheduling program. The program can be hour, day of week or day of month based.

.4 Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.

.5 The DACS shall support 5 different types of alarm output selections: Steady, Pulsed, California Standard, Temporal Code 3 and Temporal Code 4.

.5 Scheduling: The DACS shall support scheduling capabilities with the following characteristics:

.1 Arm / Disarm specific area(s) based on open/close windows.

.2 Bypass / Unbypass point(s).

.3 Activate / Deactivate relay(s).

.4 Send test reports.

.5 Up to 4 programmable holiday schedules of 366 days each (includes leap year). Based on the holiday settings, different time windows for open/close and other system functions can be executed.

.6 Automatic adjustment of system clock for daylight savings time.

.6 Communication: The DACS shall be capable of reporting system events and supervisory reports including alarm, trouble, missing modules, restorals, system status, AC failure, battery status to primary and secondary off-site DACR's. The following features shall be supported.

.1 The DACS shall be capable of communicating over a cellular network using a CDMA Cellular interface module.

.2 The DACS shall be capable of sending text (SMS) messages to compatible devices without requiring that these message are sent to a monitoring center

.3 The DACS reports shall be classified, by event, into subcategories or "report groups." Each group represents similar types of events. Individual events within each group shall be selectively enabled or disabled for transmission. The report groups shall be as follows:

.1 Burglar Reports.

.2 User Reports.

.3 Test Reports.

.4 Diagnostic Reports.

.5 Relay Reports.

.6 Auto Function Reports.

.7 RPS Reports.

.8 Point Reports.

.9 User Change Reports.

.10 Access Reports.

.7 Testing, Diagnostic, and Programming Facilities: The DACS shall be capable of sending (manually or automatically) test and status reports.

.1 The DACS shall be capable of sending automatic tests daily, weekly or once every 28 days. Automatic test times shall be programmable to provide an offset of up to 24 hours from the current time.

.2 Automatic test reports shall be programmable to be deferred by one test interval if any other report is transmitted in the current interval.

.3 Automatic test reports and remote system access for diagnostics shall be supported via a remote central station computer with Remote Programming Software (RPS).

.4 The DACS shall be programmable locally or remotely. Programming shall be accomplished via a Keypad or a computer with a remote programmer and diagnostic software package (RPS).

.5 The DACS shall allow an on-site user to initiate remote programming while on-line with the servicing location. The remote programming device must provide a compare feature and allow for downloading either the stored program or the (un)modified program copied from the panel.

.6 The DACS shall allow the local programming option to be disabled and must provide a method to program a panel while no one is on premises, when the panel shares a line with an answering machine.

.7 The DACS shall accommodate IP Diagnostic to verify settings and operation of the network interface modules; Host name, MAC address, IPV4 address assignment. The IP Connection test shall include; Link test to verify physical cable integrity, Ping test to verify gateway response, ping test to verify address on the internet.

.8 Wireless point diagnostics shall include signal strength and device states of registered wireless points in the system.

.9 The number of system testing and programming sessions shall be restricted via the use of program locking features and passwords. Passcode protection in excess of sixteen million combinations is required.

.10 New modules support enhanced diagnostics through RPS

.8 Area Re-Arm: The System shall support programmable area re-arm time of 1 minute to 24 hour.

.9 User-Programmable Features: The DACS shall provide a menu driven interface to provide a user-friendly command structure for programming / customizing the system to the operational criteria of the application. The DACS shall be capable of being operated via:

.1 The Command Structure.

.2 Menu / Command List.

2.2 CELLULAR COMMUNICATOR

.1 Provide plug-in cellular communication module for personal SMS message and e-mail notification of system event reporting.

.2 Cellular communicator shall also serve the video surveillance system, providing notification of system events generated by the surveillance system.

.3 Provide a review of the site and locate antenna to achieve best cellular communication signal possible.

.4 Bosch B443 Cellular Communicator or approved equivalent.

2.3 POWER SUPPLY

.1 120VAC-16.5VAC, 40VA system transformer.

.2 Bosch D1640-CA or approved equivalent.

2.4 ENCLOSURE

.1 Steel, NEMA 1 enclosure with continuous piano hinge securing cover/door. Enclosure to contain control panel, expansion modules, cellular communication module, wiring terminal strips. Enclosure shall be located within communications equipment rack.

.2 Tamper switch to sense when enclosure is opened.

.3 Lock and key set to secure the enclosure.

.4 Bosch D8103 (enclosure), ICP-EZTS (tamper switch) and D101 (lock set) or approved equivalent.

2.5 ALARM KEYPADS

.1 The Alarm Keypads shall accommodate viewing and configuration of system parameters.

.2 Keypads shall provide 2-line LCD display with up to 32 character point, user and area names.

.3 Bosch B921C or approved equivalent.

2.6 DOOR CONTACTS

.1 Man Doors

.1 Provide recess type, magnetic door switches suitable for installation in steel doors. Closed loop, terminal connection design.

.2 Each door switch shall be home run to the DACS control panel as a separate zone.

.3 Bosch ISN-CTC75-B or approved equivalent.

.2 Overhead Doors

.1 Provide surface mounted, magnetic door switch assembly for installation on overhead doors. Closed loop.

.2 Bosch ISN-CMET-4418 or approved equivalent.

.3 Roll Up Shutters

.1 Provide door contacts as per overhead doors; confirm requirements with shutter manufacturer prior to start of work. Utilize shutter contacts if provided.

3 Execution

3.1 EXAMINATION

.1 Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.

.2 Do not begin installation until unacceptable conditions are corrected.

.3 Ensure selected location is secure and offers protection from accidental damage.

.4 Location shall provide reasonable temperature and humidity conditions, free from sources of electrical and electromagnetic interference.

.5 Ensure power source is protected against accidental shutoff.

3.2 INSTALLATION

.1 Install all equipment and materials in accordance with the "current" recommendations of the manufacturer. The work shall also be in accordance with:

.1 Installation criteria defined in these specifications and in the construction documents.

.2 Approved submittals.

.3 Applicable requirements of referenced standards.

.2 The contractor shall provide the following services as part of the contract:

.1 Supervision of sub-contractors.

.2 Coordination of other contractors for system-related work (general contractor, electrical contractor, finish hardware contractor).

.3 Attendance at site construction/coordination meetings as required.

.4 Maintaining updated construction drawings at the construction site.

.5 Meeting construction deadlines per the construction schedule.

.3 Install panels, intrusion detection system and components secure to walls, ceilings or other substrates.

.4 Install required boxes in inconspicuous accessible locations.

.5 Wiring shall be installed in conduit raceways. Conceal conduit and wiring where possible.

3.3 PROGRAMMING

.1 Programming of the system shall include the following tasks:

.1 Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).

.2 Programming operational parameters such as opening/closing reports and windows, system response text (custom English) displays of events, activation of relays that drive auxiliary devices, and identifying types of zones/loops.

.3 Programming passcodes according to the authorities and functions defined by the Owner.

.4 Programming of SMS and email messages to be sent via cellular communication for system events.

.5 Other system programming tasks required by the Owner. These additional programming requirements shall be coordinated between the owner and the Contractor.

3.4 FIELD QUALITY CONTROL

.1 Operational Testing: The Contractor shall perform thorough operational testing and verify that all system components are fully operational.

.2 Hard-copy System Printout: The Contractor shall submit a hard-copy system printout of all components tested and certify 100 percent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.

.3 Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the Contractor prior to the acceptance walk-through. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the Contractor (pass/fail), and an empty column for recording findings during the walk-through.

.4 The Contractor shall certify completion in writing and schedule the commissioning walk-through. The Contractor shall provide all the tools and personnel needed to conduct an efficient commissioning process.

.5 The Contractor shall submit a written test report that the system has been 100 percent tested and approved. Final test shall be witnessed by the Owner, Engineer, General Contractor, and Electrical Contractor and performed by the installing Contractor. Final test report shall be received and acknowledged by the Owner prior to request for final payment.

.6 Provide instruction to the Owner's satisfaction with regard to proper use and operation of the system.

.7 Determine and report all problems to the manufacturer's customer service department.

3.5 ADJUSTING

.1 System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).

.2 Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the monitoring connection.

.3 The installer shall correct any system defect within six hours of receipt of call from the Owner.

3.6 DEMONSTRATION

.1 Demonstrate at final inspection that intrusion system and devices function properly.

.2 The Contractor upon completion of installation shall furnish training in the complete operation of the systems. Allow two (2) training sessions, each of two hours duration at the site. Training shall be scheduled, in coordination with the Owner, for separate dates (not concurrent on one day).

3.7 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before substantial completion

END OF SECTION

1 General

1.1 GENERAL

.1 All conditions of the Contract apply to the work of this Section

1.2 RELATED WORK

.1 General Electrical Requirements - Section 26 05 00.

.2 Structured Cabling for Communications Systems – Section 27 10 05.

.3 Intrusion Detection – Section 28 16 00.

1.3 SCOPE

.1 Labour, products, equipment and services necessary to complete the work of this Section.

.2 Provide a complete and functional video surveillance system as detailed herein.

.3 Video surveillance system shall be integrated with the intrusion alarm system.

.4 System shall include all required licenses, software and accessories for a complete and functional installation.

.5 Provide set-up, commissioning, testing, demonstration and training.

.6 Refer to contract drawings for quantity and location of equipment.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00, General Electrical Requirements and the requirements of Division 1.

1.5 WARRANTY

.1 Manufacture shall provide a three (3) year replacement warranty on all cameras and NVR equipment.

2 Products

2.1 NETWORK VIDEO RECORDER

.1 All in one (recording, viewing and management) network video recording device for video surveillance system of up to 32 channels.

.2 All components and software shall be pre-installed and pre-licensed. A pre-installed license shall be included for the Intrusion Panel.

.3 4 TB (2 x 2TB) of gross storage capacity, 3.6 TB net capacity.

.4 Power Supply: 120VAC

.5 Power Consumption: 114W max

.6 Operating Temperature: 10°C to 35°C.

.7 Operating Humidity: 8% to 90% non-condensing

.8 Bosch DIP-3042-2HD or approved equivalent.

2.2 CAMERAS

.1 Wall or ceiling mounted, vandal resistant IP dome camera for outdoor HD surveillance.

.2 Video Resolution: 1080p, 1920 (H) x 1080 (V), 2MP (approx.)

.3 Optical:

.1 Lens Type: 3 to 10mm Automatic Varifocal (AVF) lens, IR corrected.
DC Iris F1.3 – 360

.2 Adjustment: Motorized zoom/focus

.3 Iris Control: Automatic iris control

.4 Day/Night: Switched mechanical IR filter.

.5 Horizontal field of view: 34° - 101°

.6 Vertical field of view: 19° - 54°.

.7 Automatic image Rotation

.4 Power:

.1 Input Voltage: Power-over-Ethernet (48Vdc nominal)

.2 Power Consumption: 8.5W max (PoE)

.3 PoE IEEE Standard: IEEE 802.3af (802.3at Type 1)
Power level: Class 3.

.5 Sensitivity:

.1 Colour: 0.12lx

.2 Mono: 0.02lx

.3 With IR:0.0lx.

.6 Environment: outdoor.

.7 Additional features: backlight compensation.

.8 Adjustment (pan/tilt/rotation): 350° / 130° / 330°

.9 Operating Temperature: -40°C to 50°C for continuous operation.

.10 Operating Humidity: 5% to 93% non condensing

.11 Aluminum housing with clear polycarbonate dome bubble.

.12 IP66 rated ingress protection.

.13 Bosch NDE-4502-AL or approved equivalent.

2.3 ACCESSORIES

.1 Equipment Rack

.1 EIA compliant 19" ready-to-assemble equipment rack.

.2 Coordinate size of rack with layout of equipment to be installed.

.3 Rack shall be constructed of the following materials:

.1 top and bottom shall be 14-gauge steel,

.2 horizontal braces shall be 16-gauge steel welded to integral structural side panels of 16-gauge steel giving an 1/8" [3mm] thick structure,

.3 all structural elements shall be finished in durable black powder coat paint.

.4 Rack shall come equipped with one pair of 11-gauge steel rack rail with tapped 10-32 mounting holes in universal EIA spacing, black e-coat finish and numbered rack spaces.

.5 Rack shall include 16 gauge steel front door (vented Plexiglas), and solid side panels with vertical slotted vent pattern at top and bottom and laser knockouts for cable pass-through. Top and bottom of rack shall feature vertical slotted vent pattern. Back of rack shall be open.

.6 Grounding and bonding stud shall be 1/4-20 threaded, installed in base of enclosure.

.7 Middle Atlantic ERK Series or approved equivalent.

.2 Rack Mounted Power Distribution Unit

.1 EIA compliant 19” Rackmount power strip with a 20 amp power capacity and EMI filtering.

.2 Rackmount power strip shall have enhanced surge protection with no surge diversion to ground.

.3 Rackmount power strip shall operate on 120 volt AC/60Hz current.

.4 Rackmount power strip shall include 2.7m power cord with NEMA 5-20P plug.

.5 8 rear outlets, 1 front outlet, and 20 amp circuit breaker located on the power strip’s rear.

.6 Rackmount power strip shall occupy one rack space and be constructed of 18-gauge phosphate pre-treated steel with a black powder coat finish.

.7 Middle Atlantic PD-920R-NS or approved equivalent.

.3 Uninterruptible Power Supply

.1 Rack mounted model, supplied with rail kit.

.2 120VAC 15Amp input, 120VAC 1500VA/1350W output.

.3 Standard runtime of 5 minutes (minimum) at full load without extended battery modules.

.4 Eaton Powerware PW9130L1500R or approved equivalent.

.4 Data Switch

.1 Provide a PoE managed, layer 3 switch to manage QoS.

.2 Switch to serve the video surveillance and intrusion alarm systems.

.3 16 port, Class 3 PoE available on all ports.

.4 Minimum 10W / port / device.

.5 No green switches to be provided.

.6 Cisco or approved equivalent.

.5 Patch Panels

.1 Refer to Section 27 10 05, Structured Cabling for Communications Systems for requirements pertaining to rack mounted patch panels.

.6 Rack Mounted Monitor and Keyboard with Touchpad

.1 High definition (1080P), widescreen (16:9) display.

.2 Designed for digital video, featuring an HDMI certified 100% digital platform including HDMI/DVI inputs and HDCP compliance.

.3 Compatible with industry standard cables and extenders.

.4 Compact, 1-rackspace design includes 17” widescreen display, keyboard and touchpad.

.5 Dual rail design allows monitor to reside in open position for system monitoring while keyboard is recessed.

.6 Middle Atlantic RM-KB-LCD17HCD or approved equivalent.

2.4 CABLING

.1 Refer to Specification section 27 10 05 for cabling requirements.

3 Execution

3.1 EXAMINATION

.1 Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.

.2 Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

.1 Protect devices from damage during construction.

.2 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheet.

.3 Install video surveillance equipment and components in accordance with ULC-S317.

.4 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.

.5 Install components secure, properly aligned and in locations shown on reviewed shop drawings.

.6 Connect cameras to cabling in accordance with installation instructions.

3.3 FIELD QUALITY CONTROL

.1 Test snugness of mounting screws for all installed equipment.

.2 Test proper operation of all video system devices.

.3 Manufacturer's Field Services:

.1 Obtain written reports from manufacturer’s representative verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

3.4 SYSTEM STARTUP

.1 Provide all necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors, manufacturer's representatives and Owners representatives are present for verification.

.3 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

.1 Sturdiness of equipment fastening.

.2 Non-existence of installation related damages.

.3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.7 Application and location of ULC approval decals.

.4 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of tension and power.

.2 Connecting joints and equipment fastening.

.3 Measurements of signals (dB, lux, baud rate, etc).

.4 Compliance with manufacturer's specification, product literature and installation instructions.

.5 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:

.1 Operation of each device individually and within its environment.

.2 Operation of each device in relation with programmable schedule and or/specific functions.

.3 Operation control of camera lens, pan, tilt and zoom.

.4 Switching of camera to any monitor.

.5 Switching of system video recorder to selective monitor.

.6 Set dwell times.

3.5 ADJUSTING

.1 Remove protective coverings from cameras and components.

.2 Adjust cameras for correct function in accordance with manufacturer’s instructions.

.3 Make any adjustment of camera settings to comply with specific needs of Owner.

3.6 CLEANING

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

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

.3 Clean camera housing, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

3.7 DEMONSTRATION

.1 Demonstrate at final inspection that video management system and devices function properly.

.2 Provide two (2) two hours sessions at the installation site to provide demonstration and training to the Owner. Session dates to be scheduled by the Owner for different dates (not concurrent on same date).

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 Payment Procedures

.2 Section 01 35 43 Environmental Procedures

.3 Section 01 55 26 Traffic Control

.4 Section 01 56 00 Temporary Barriers and Enclosures

.5 Section 01 74 00 Cleaning and Waste Management

.6 Section 01 74 21 Construction Demolition Waste Management and Disposal

1.2 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 201 – Construction Specification for Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders

1.3 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

.3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.

.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.

.5 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments.

1.4 STORAGE AND PROTECTION

.1 Prevent damage to trees, natural features, bench marks, existing buildings, existing pavement, utility lines and any other feature which are to remain.

.1 Repair damaged items to approval of Parks Canada Representative and Consultant at no additional cost.

.2 Replace trees designated to remain, if damaged, as directed by Parks Canada Departmental Representative and Consultant.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and or recycling in accordance with Section 01 74 21 – Construction Demolition Waste Management and Disposal.

2 Products

Not Used

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 and sediment and erosion control drawings.

.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 PREPARATION

.1 Inspect site and verify with Parks Canada Departmental Representative and Consultant, items designated to remain. If there are trees that require removal during the general regional nesting periods, a Parks Canada Departmental Representative shall conduct an inspection to determine if nesting birds are present and provide direction as to the removal or avoidance is necessary.

.2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.

.1 Notify Parks Canada Departmental Representative and Consultant immediately of damage to or when unknown existing utility lines are encountered.

.2 When utility lines which are to be removed are encountered within area of operations, notify Parks Canada Departmental Representative and Consultant in ample time to minimize interruption of service.

.3 Notify utility authorities before starting operations.

.4 Keep roads and walks free of dirt and debris.

3.3 CLEARING

.1 Clearing includes felling, trimming, cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.

.2 Clear as directed by Parks Canada Departmental Representative and Consultant, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

.3 Cut off branches, cut down trees, and overhanging area cleared as directed by Parks Canada Representative and Consultant.

.4 Cut off unsound branches on trees designated to remain as directed by Parks Canada Departmental Representative and Consultant.

3.4 CLOSE CUT CLEARING

.1 Close cut clearing to ground level.

.2 Cut off branches, down trees, and overhanging area cleared as directed by Parks Canada Departmental Representative and Consultant.

3.5 ISOLATED TREES

.1 Cut off isolated trees as directed by Parks Canada Departmental Representative and Consultant at height of not more than 300 mm above ground surface.

.2 Grub out tree stumps.

.3 Prune individual trees as indicated.

.4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.

.5 Cut limbs and branches to be trimmed close to bole of tree or main branches.

3.6 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level to ground surface.

3.7 GRUBBING

.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.

.2 Grub out stumps and roots to not less than 200 mm below ground surface.

.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m3.

.4 Fill depressions made by grubbing with suitable material and to make new surface conform to existing adjacent surface of ground.

3.8 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site as designated by Parks Canada Departmental Representative and Consultant.

.2 Materials to be removed in accordance with 01 74 21 – Construction Demolition

.3 Waste Management and Disposal.

.4 Stockpile any materials designated to remain as directed by Parks Canada Departmental Representative and Consultant and in accordance with 01 74 21 – Construction Demolition

.5 Waste Management and Disposal.

3.9 FINISHED SURFACE

.1 Leave ground surface in condition suitable for stripping of topsoil and organic surface material as required for grading operations to approval of Parks Canada Departmental Representative and Consultant.

3.10 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning and Waste Management.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 29 83 - Payment Procedures for Testing Laboratory Services

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 74 00 – Cleaning and Waste Management

.7 Section 01 74 21 – Construction Demolition Waste Management and Disposal

1.2 REFERENCE STANDARDS

.1 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS.MUNI 206 – Construction Specification for Grading.

.2 OPSS.MUNI 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

1.3 EXISTING CONDITIONS

.1 Examine geotechnical investigation report which is appended to these specifications.

.2 Contractor is to carefully examine site prior to commencing operations and to advise Parks Canada Departmental Representative and Consultant of any situations or unforeseen issues which may affect performance of work.

2 Products

2.1 MATERIALS

.1 Fill material: Granular ‘B’ Type 2 in accordance with OPSS.MUNI 1010.

.2 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Parks Canada Departmental Representative and Consultant.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate are acceptable for rough grading.

.2 Visually inspect substrate in presence of Parks Canada Departmental Representative and Consultant.

.3 Inform Parks Canada Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.

.4 Proceed with work only after unacceptable conditions have been remedied and after receipt of approval to proceed from Parks Canada Departmental Representative and Consultant.

3.2 STRIPPING OF TOPSOIL AND ORGANIC MATERIAL

.1 Commence topsoil and organic stripping of areas as directed by Parks Canada Departmental Representative and Consultant after area has been cleared and grubbed.

.2 Strip topsoil and organic material down to bedrock or competent substrate as approved by Parks Canada Departmental Representative and Consultant.

.3 Stockpile in locations as directed by Parks Canada Departmental Representative and Consultant. Stockpile height not to exceed 2 m. Stripped soil shall be used in the construction of the leaching bed base per sections on L 09.

.4 Dispose of unused topsoil and organic material off site.

3.3 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

.1 320 mm below proposed parking lot surface grades with permeable pavers.

.2 275 mm below proposed 125 mm th. concrete walkways surface grades.

.3 300 mm below proposed 150 mm th. concrete paving surface grades.

.4 350 mm below proposed 200 mm th. concrete paving surface grades

.5 540 mm below proposed asphalt paving surface grades.

.3 Slope rough grade away from building 1:50 minimum and as directed by Parks Canada Departmental Representative and Consultant.

.4 Grade ditches to depth as indicated.

.5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground.

.6 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:

.1 85% under landscaped areas.

.2 95% under paved areas.

.7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.4 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory approved by Parks Canada Departmental Representative. Costs of tests will be paid by Parks Canada in accordance with Sections 01 29 83- Payment Procedures for Testing Laboratory Services and 01 45 00- Quality Control.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning and Waste Management.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning and Waste Management.

.3 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21- Construction Demolition Waste Management and Disposal.

3.6 PROTECTION

.1 Protect all existing trees, fencing, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Parks Canada Departmental Representative and Consultant. If damaged, restore to original or better condition at no additional unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris and run off on to roads.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.9 Section 31 22 13 – Rough Grading

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement Procedures:

.1 Quantities will be taken from cross section showing original rock surface and actual grade line set by Parks Canada Departmental Representative and Consultant.

1.3 REFERENCE STANDARDS

.1 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS.MUNI 403 – Construction Specification for Rock Excavation for Pipelines, Utilities and Associated Structures in Open Cut.

1.4 DEFINITIONS

.1 Rock: any solid material in excess of 0.25 m3 and which cannot be removed by means of heavy duty mechanical excavating equipment. Frozen material not classified as rock.

.2 PPV: peak particle velocity.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Indicate proposed method of carrying out work.

2 Products

NOT USED

3 Execution

3.1 ROCK REMOVAL

.1 Perform rock removal in accordance with OPSS.MUNI 403.

.2 Blasting is not permitted.

.3 Use of hydraulic and pneumatic excavation equipment is the only accepted method.

.4 Remove rock to alignments, profiles, and cross sections as indicated.

.5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.

.6 Remove boulders and fragments which may slide or roll into excavated areas.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

.2 Rock Disposal:

.1 Dispose of surplus removed rock as directed by Parks Canada Departmental Representative and Consultant.

.2 Do not dispose removed rock into landfill. Send material to appropriate quarry as approved by Parks Canada Departmental Representative and Consultant.

.3 Stockpile rock to designated area for landscaping and fill purposes.

3.3 PROTECTION

.1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00-Temporary Barriers and Enclosures.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Divisions 20 & 26: Trenching, Excavation and Backfill Required by the Mechanical and Electrical Sections.

.2 Contractor shall be responsible for coordinating this section with all related sections.

1.3 SITE CONDITIONS

.1 Examine Site:

.1 Note all characteristics and features affecting work. No allowance will be made for difficulties encountered or expenses incurred on account of any site conditions or any growth or item existing thereon, visible or known to exist when bid is submitted.

.2 Underground Services:

.1 Notify public utilities or municipal authorities in advance of planned excavations adjacent to their services. Take care not to damage or displace encountered known and unknown services. When such services are encountered, immediately notify Consultant, and protect, brace and support active services. Where repairs become necessary, use the following procedure:

.2 Known Services:

.1 Repair at no expense to Owner.

.3 Unknown Services:

.1 Forward complete breakdown of estimated cost of such work. Proceed immediately with repairs upon receipt of written approval of cost of such repair work.

.4 In the case of damage to an essential service, notify Consultant immediately and repair service under Consultant's direction. Inform Consultant of services encountered which require adjustment, relocation or abandonment and arrange for disconnection and capping of pipe.

1.4 GEOTECHNICAL SITE INVESTIGATION REPORT

.1 Review in detail geotechnical site investigation report prepared by GM Blueplan dated October 2017. Information given in Geotechnical Site Investigation Report was obtained for use of Owner in execution of design. It is presented in good faith to assist Contractor. No guarantee is made as to its detailed accuracy for every site location.

1.5 LEVELS

.1 Existing grade levels shown on drawings are furnished in good faith for the guidance of the Contractor. Check and verify levels at site. Should the actual grade levels of the site be other than shown, no claims will be entertained unless notification is made in writing to the Consultant. Do not proceed with the work until Consultant's approval is received. Allow Consultant sufficient time to inspect such claim.

1.6 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Stockpile materials in designated areas. Stockpile topsoil and each type of fill material separately to prevent integration. Stockpile granular materials so as to prevent segregation.

.2 Keep surrounding roads free of soil deposits from material hauling trucks. Load trucks carefully to prevent spillage and wind drift.

.3 To protect neighbourhood from wind-blown sand and dust, sprinkle with water entire excavated area and stockpiled excavated materials when required.

.4 Protect adjacent property from damage which may occur from any cause in the performance of the work of this Section.

.5 Do not interfere with use of adjacent buildings.

.6 Take precautions against movement, settlement or collapse of sidewalks, public services adjoining property and be liable for all damage to same.

.7 Before commencing work verify location of survey monuments in the areas in which the work is to be executed. Should any of the monuments be disturbed due to the work be responsible for the expenditures incurred in restoring the monuments.

.8 Take precautions against movement or settlement of existing building. Provide and place bracing and shoring necessary for the safety and support of the structure and execute the work in a manner to prevent movement, settlement, damage or injury caused thereby or resulting therefrom.

.9 Shoring and Trench Timbering:

.1 In addition to requirements of local authorities, carry out in accordance with requirements of the Occupational Health and Safety Act, RSO 1990 C.0.1 and regulations for construction projects, and all other applicable regulations of the Ontario Ministry of Labour. In addition, follow recommendations of the Construction Safety Association brochure, "Shoring and Timbering in Trenches, latest edition", wherever applicable.

.10 Shoring and Bracing:

.1 Erect and maintain necessary shoring and bracing for excavations in a manner that will properly retain banks of excavations and prevent cave-in. Shoring to be erected in a manner that will allow all other work to be carried out while shoring is still in place. Shoring installation shall be entirely clear of footings, foundations, walls or other such work so that it may be removed entirely or in sections when it is no longer required or when directed without causing any damage or injury to structural work that has been completed.

2 Products

2.1 MATERIALS

.1 Fill Material:

.1 For base under floor slabs and other locations as recommended by geotechnical investigation report, shall be Granular 'A' material in accordance with OPSS.MUNI 1010 Table 1 and 2, well graded and maximum aggregate size of 20mm (3/4"). Material shall be maintained at optimum moisture content during placing and while compacting work is in progress, in strict accordance with inspection engineer's instructions and to his approval.

.2 For other locations as recommended by geotechnical investigation report, shall be Granular 'A' or Granular ‘B’ (Type I, II or III) material in accordance with OPSS.MUNI 1010 Table 1 and 2, well graded and maximum aggregate size of 37.5mm (1-1/2”). Material shall be maintained at optimum moisture content during placing and while compacting work is in progress, in strict accordance with inspection engineer's instructions and to his approval.

3 Execution

3.1 PREPARATION

.1 Clear and remove, from site, obstructions to excavating. Establish and maintain accurate lines and levels as required. Provide batter boards, line stakes and templates, and establish permanent reference lines and bench marks required.

3.2 EXCAVATION - GENERAL

.1 Excavate with due regard for the peculiarities of soil conditions and take precautions to protect adjacent foundations and property.

.2 Excavate and remove sod, debris, topsoil or fill deposited within the building area. Remove topsoil to its full depth over the areas to be excavated or graded.

.3 Stockpile topsoil in a neat pile where directed. Remove surplus topsoil not required for regrading or landscaping from the site or as directed by Parks Canada Departmental Representative.

.4 Stockpile excavated material approved for re-use on the site so that such material will not interfere with site drainage, drainage of adjacent properties, or building operations. Remove subsoil and excavated material not required for regrading outside the building from the site, including material excavated by other Sections.

.5 Excavate to extent, elevations and depths required for completion of work, leaving sufficient space for removal of formwork, application of and installation of weeping drains. Excavate and construct for slabs, ramps, and driveways, to lines, elevations and cross sections shown on drawings to allow finishing sections to install their work to required thicknesses.

.6 Keep excavation free of water by bailing, pumping or system of drainage as required, and provide pumps, suction and discharge lines of sufficient capacity. Maintain until such time as permanent drainage system is installed or until Consultant's approval for removal of equipment is obtained. Take all necessary measures to prevent flow of water into excavation.

.7 Protect bottom and sides of excavated pits and trenches from freezing.

.8 Keep bottoms of excavations clean and clear of loose materials leveled and stepped at changes of levels except excavations made for drainage purposes which are to slope as required.

.9 If removal of earth causes displacement of adjacent earth, remove disturbed earth at no additional cost to Owner.

.10 Remove soft, wet or unconsolidated ground, quicksand and organic material encountered in excavating and fill void with well compacted, clean, dry fill of quality as herein specified. Where these conditions occur under or near footings, special arrangements will be made by Consultant. Similarly treat wells, cesspools, pits, etc. if encountered.

.11 After completion of excavation and prior to placing concrete or fill, notify inspection engineer so they may make inspection of exposed bearing surfaces. In event founding levels are subjected to rain or other moisture after inspection and approval but prior to installation of concrete, notify inspection engineer to re-examine all exposed bearing surfaces. Do not place concrete until re-examination has taken place and approval given.

.12 Provide protection to keep surface against which concrete or fill is to be placed free of frost. Thaw frozen surfaces against which concrete or fill is to be placed to unfrozen depth. Remove thawed softened material to firm base at no extra cost to Owner.

.13 Excavate for footings to firm, undisturbed subsoil capable of safely supporting respective soil bearing values shown.

.14 Should nature of subsoil at depths shown prove to be unsatisfactory for placing of structural work thereon, then upon Consultant's written order, excavate to greater depth until satisfactory bottom is reached. Payment for such additional excavation and backfill will be on basis of contract unit prices.

.15 If excavations reveal seepage zones, springs or other unexpected subsurface conditions which may necessitate revisions or additions to any drainage system, inform Consultant immediately for remedial action.

.16 Excavated surfaces scheduled to receive concrete skim slabs shall be protected from excessive traffic and other disturbances and shall not be left exposed for extended periods of time. Coordinate work with Section 03 30 00 to allow for immediate installation of skim slabs.

3.3 TRENCH EXCAVATING

.1 Excavate with suitable machinery or by hand as may be necessary to depths and dimensions shown or required.

.2 Cut and trim sides of trenches evenly and as near vertical as possible, shore as required to prevent cave-ins.

.3 Keep bottoms of trenches clean and clear of loose material. Slope or grade as required. Hand trim at least last 100mm (4") of trench excavations to ensure minimum disturbance to load bearing value of trench bottoms.

3.4 BACKFILLING

.1 Proceed promptly with backfilling as building progresses and work to be backfilled has been inspected and approval to backfill obtained. Place backfill in 200mm (8") thick maximum layers. Compact each layer before placing next. Maintain optimum moisture content to achieve required densities.

.2 Backfill evenly on both sides of foundation walls to avoid unequal fill pressures on walls.

.3 Fill over-excavations under bearing surfaces and footings, or within pyramid enclosed by 7 in 10 slope from bearing surface with concrete of same strength as specified for footings. Fill over-excavation under all other areas with approved sand/gravel mixture and compact as directed. Fill over excavation at no additional cost to Owner.

.4 Withdraw shoring material during backfill.

.5 Place fill around foundation walls to that footings will have a minimum 1500mm (5'-0") coverage, measured at 45 deg angle from bottom of footing to protect against frost until final grading is complete.

.6 Compaction equipment to be of size and type to permit required compaction without causing lateral forces resulting in displacement of foundation walls. Exercise caution in this regard to avoid movement of foundations.

.7 Backfill and fill shall not be placed over debris, organic matter, snow, ice or frozen ground. Fill shall not be placed at ambient air temperatures below $0^{o}C$ without approval.

.8 Take care to avoid damage to waterproofing or displacement of waterlines, drains, conduit and other underground installations.

.9 Prior to placing fill for concrete floor slabs on earth, consolidate subgrade to obtain same compaction specified for fill material.

.10 Compact soil materials to the percentages of maximum dry unit weight in accordance with ASTM D 698, and in accordance with the drawings and the Geotechnical Report.

.11 Coordinate with Work of other Sections for the lines and levels of uncompacted subgrade required by those Sections.

.12 Compact with mechanical tampers, areas adjoining vulnerable building components which cannot be thoroughly compacted by drawn equipment.

.13 Install Granular 'A' where required, as recommended by Geotechnical Investigation Report.

3.5 TESTING

.1 Sequentially test each stage of backfill commencing at founding elevations and continuing through installation of subsequent lifts or material and compaction thereof.

.2 Do not proceed with installation of any material until preceding surface or layer meets design criteria. Owner will engage and pay for independent testing agency to conduct testing in addition to tests noted in paragraph above.

3.6 COMPACTION

.1 Density of fill in place shall be in accordance with latest revision of ASTM D698-91, 98% Standard Proctor Density for all fill unless specifically noted otherwise. Fill to underside of asphalt base - 98% Standard Proctor Density.

.2 Maintain optimum moisture content during backfill and fill compaction to achieve required density. Deposit in layers of such thickness that equipment being used for compacting can produce specified density.

.3 Puddling or flooding with water for consolidating granular fill will not be permitted. Addition of water is limited only to extent required to provide optimum moisture level of fill material.

.4 During and immediately after levelling, thoroughly compact each layer of fill by use of compaction equipment of size and type to permit required compaction without causing lateral forces resulting in displacement of foundation walls. Exercise caution in this regard to avoid movement of foundations.

.5 After a period adequate to reveal settlement has passed, place additional fill and compact in all depressions. Make good any subsequent settlement without extra cost to Owner.

3.7 WATER ON PREPARED SURFACES

.1 Promptly remove by approved methods, water rising from seeping or resulting from rainfall wherever such water is on surface of subgrade soil and compacted fill.

.2 Where proper drainage and pumping is not carried out as specified herein and any prepared subgrade soil under structural work, and any compacted fill under concrete slabs is softened or disturbed by water due to improper drainage and pumping, Contractor under this Section shall (A) without extra cost to Owner, remove unsatisfactory soil and fill; and (B) bear all incidental costs in connection with additional excavation, backfilling and structural work for footings and foundations, and additional excavation and placing and compacting of granular fill under concrete slab base course.

3.8 ROUGH GRADING

.1 Rough grade to profiles shown on required levels to allow installation of follow-up materials to produce final grades at levels indicated. Rough grade surface to be suitable to accept follow-up sections work.

3.9 DISPOSAL OF DEBRIS AND SURPLUS MATERIAL

.1 Remove from site and legally dispose of all rubbish, rocks and surplus materials resulting from site stripping, excavation and grading work.

.2 Vehicles employed in the cartage of this material shall not be loaded beyond the rated limits, nor in such a manner as to cause spillage. Any spillage or tire tracking occurring upon public property or upon the property of others, shall not be allowed to remain to become a hazard and a nuisance but shall be cleaned up immediately.

.3 Break rock, concrete and unit masonry into pieces not exceeding 600mm (24") in any dimension.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply and installation of asphalt pavement structures and pavement line markings.

.2 Subgrade preparation and placement of granular base are addressed in Section 31 23 33.

1.2 RELATED REQUIREMENTS

.1 Section 31 23 33: Excavation, Trenching and Backfilling

.2 Section 32 16 26: Concrete Curbs and Sidewalks

.3 Section 32 17 23 Pavement Markings

1.3 REFERENCE STANDARDS

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

.1 ASTM D242-09, Standard Specification for Mineral Filler for Bituminous Paving Mixtures

.2 ASTM D692/D692M-09, Standard Specification for Course Aggregate for Bituminous Paving Mixtures

.3 ASTM D946/D946-09a, Standard Specification for Penetration Graded Asphalt Cement for Use in Pavement Construction

.4 ASTM D979/D979M-12, Standard Practice for Sampling Bituminous Paving Mixtures

.5 ASTM D995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

.6 ASTM D1073-11, Standard Specification for Fine Aggregate for Bituminous Paving Mixtures

.7 ASTM D5581-07ae1, Standard Test Method for Resistance To Plastic Flow Of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen)

.8 ASTM D2027/D2027M-10, Standard Specification for Cutback Asphalt (Medium-Curing Type)

.9 ASTM D3515-01, Standard Specification for Hot-Mixed, Hot -Laid Bituminous Paving Mixtures

.2 Asphalt Institute:

.1 Asphalt Institute IS-91, Full-Depth Asphalt Pavements for Parking Lots, Service Stations and Driveways.

.2 Asphalt Institute MS-4, The Asphalt Handbook.

.3 Asphalt Institute SS-1, Model Construction Specifications for Asphalt Concrete.

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

.2 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.

.3 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

.4 CAN/CGSB-16.3-M90, Asphalt Cements for Road Purposes.

.5 CAN/CGSB 1.5-M-91, Low Flash Petroleum Spirits Thinner.

.6 CGSB-1.74-2001, Alkyd Traffic Paint.

1.4 QUALIFICATIONS

.1 Asphalt concrete mixing plants shall conform to ASTM D995.

.2 Provide the equipment, materials, and labour to complete the job. Variations in the size and amount of equipment will depend on the size of the area being paved.

1.5 BASIS OF PAYMENT

.1 Payment will be on a stipulated price payment that includes for furnishing, hauling and placement of materials, for rolling, compaction and labour, and use of equipment, tools and incidentals necessary to complete the work of this section. Report immediately site conditions that differ significantly from those anticipated. Consultant will provide clarification or request a change to the work for an adjustment to the contract price.

1.6 SUBMITTALS

.1 Provide required product information in accordance with Section 01 33 00.

.2 Submit asphalt concrete mix design and list of equipment and materials proposed for use to Consultant for review.

.3 Submit a certificate of compliance indicating that the asphalt meets the requirements of the specifications, standards listed above and good local construction practices.

.4 Submit proposed design for grading and pavement construction for Consultants review. Indicated direction of flow, site water retention area meeting City requirements, thickness and types of asphalt, line painting and pre-cast curb placement, stamped and signed by professional engineer.

1.7 TESTING

.1 Materials shall be tested by accredited testing laboratory and included in Bid Price.

.2 Sampling will follow recommended practice of ASTM D979.

.3 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

1.8 WARRANTY

.1 Provide a materials and workmanship bond for an additional period of three (3) years taking effect after one year warranty required by CCDC 2. Bond shall cover defects in material and workmanship affecting the appearance and long term performance of the completed installation.

2 Products

2.1 HOT-MIX, HOT-LAID ASPHALT

.1 Design and prepare plant hot-mixed, hot-laid pavement mixtures utilizing asphalt cement and aggregate in accordance with ASTM D3515 and the following requirements.

2.2 BITUMINOUS MATERIALS

.1 Asphalt Cement:

.1 Parking Areas: Penetration grade of 200 to 300 in accordance with to ASTM D946.

.2 Aggregates shall be coated with a minimum film thickness of 6.5 μm in accordance with Marshall Mix Design Criteria and requirements of ASTM D5581.

.2 Tack Coat: Emulsified anionic asphalt, SS-1 or SS-1h mixed with water and meeting the requirements of ASTM D977.

.3 Primer Coat: medium curing, medium viscosity cutback asphalt, MC-80 meeting the requirements of AASHTO M82 and ASTM D2027.

2.3 MINERAL AGGREGATE

.1 Mineral aggregate for asphalt plant-mix shall consist of crushed stone, crushed gravel, sand, mineral filler, to ASTM D692 and ASTM D1073 and mineral filler. Mineral filler may be Portland cement, pozzolan, or commercially ground stone dust conforming to ASTM D242, and as follows:

.1 Coarse aggregate shall be sound, angular crushed stone, crushed gravel, or crushed slag. Uncrushed coarse aggregate may be used in base course mixtures if the mixture meets all design criteria. The fine aggregate shall be well graded, moderately sharp to sharp sands.

.2 Mineral aggregate and asphalt shall be combined in a mixing plant to meet the following nominal gradations for asphalt concrete:

Base and Surface Asphalt for new paving

Sieve Size	% Passing by Weight	
3/4"	100	
3/8"	60-80	
#4	40-65	
#8	30-50	
#30	15-30	100
#50	10-25	95-100
#100	5-20	
#200	3-8	70-100

Asphalt content as a percentage of weight by total mix shall conform to the requirements of Asphalt Institute MS-4.

2.4 ACCESSORIES

.1 Line Paint:

.1 To CGSB 1-GP-74M, alkyd traffic paint; colour, yellow, and as indicated on Drawings.

.2 Thinner: To CAN/CGSB-1.5.

.2 Cast-in-place Concrete Curbs:

.1 Concrete ingredients, admixtures and reinforcing steel to CSA A23.4.

.2 Anchors: Smooth10mm (3/8") dia reinforcing bars, pointed at one end, minimum length to penetrate 457mm (18") through asphalt and subgrade.

.3 Finish and colour of precast concrete, standard gray, as indicated in Section 32 16 26.

.3 Adjustment Rims: as required to adjust elevation of manhole rims and valve chambers.

3 Execution

3.1 PREPARATION

.1 Grades and elevations shall be established by the Contractor, and as follows:

.1 The Contractor shall set grade stakes to the correct elevation.

.2 Coordinate grades with existing features and adjoining properties to ensure proper drainage.

.2 Remove all debris, vegetation, and other deleterious materials from the site, except for trees or shrubs designated for preservation.

.3 Grade site in accordance with required profiles and remove excess material removed from site.

.4 Compact subgrade at the lowest moisture content such that firm closing of hand can mould a handful of soil:

.1 Surface of subgrade after compaction shall be hard, uniform, smooth, and true to grade and cross-section. Confirm compaction by driving a heavily loaded truck over subgrade and verify that minimal deflection occurred.

.2 Roll subgrade to correct conditions where significant deflection occurs.

.3 Scarify subgrade to a depth of 150mm (6") and recompact where rolling does not correct the soft condition.

.4 Remove and replace subgrade with select materials where re-compaction does not correct soft condition.

.5 Treat subgrade with a soil sterilant at the rate specified by the manufacturer to prevent the growth of weeds prior to placing base courses.

.6 Prepare granular base courses in accordance with Section 31 23 33.

.7 Apply cutback asphalt prime coat to prepared granular base courses at a minimum rate of 0.7 L/m^2 (0.15 gal/yd^2).

3.2 PAVEMENT CONSTRUCTION

.1 Light Traffic Construction: Lay plant hot-mixed, hot laid asphalt on prepared subgrade and base courses to a total thickness of 100 mm, unless otherwise indicated on Drawings. Place material in a single thick lift during weather colder than 5 deg C (40 deg F).

.1 Asphalt base course (HL-4) shall be laid to a compacted thickness of 50mm.

.2 Asphalt surface course (HL-3) shall be laid to a compacted thickness of 50mm.

.2 Spreading Base and Surface Courses:

.1 For areas greater than 840 m^2 (1,000 yd^2):

.1 Asphalt base and surface courses shall be spread and struck off with a paver.

.2 Any irregularities in the surface of the pavement course shall be corrected directly behind the paver.

.3 Excess material forming high spots shall be removed with a shovel or a lute.

.4 Indented areas shall be filled with hot mix and smoothed with a lute or the edge of a shovel being pulled over the surface.

.5 Casting of mix over such areas shall not be permitted.

.6 For areas less than 840 m^2 (1,000 yd^2) and in areas where it is not practical to use a paver or spreader box:

.7 Spread asphalt base and finish surface courses by hand.

.8 Use rigidly supported wood or steel forms to ensure correct grade and cross-section

.9 Placing by hand shall be performed carefully to avoid segregation of the mix.

.10 Broadcasting of the material will not be permitted.

.11 Any lumps that do not break down readily shall be removed.

.3 Roll and compact hot-mix material immediately without displacement; continue rolling until thoroughly compacted and all roller marks have disappeared.

.4 In areas too small for the roller, a vibrating plate compactor or hand tamper shall be used to achieve thorough compaction.

.5 The surface of the completed work shall be level to 6mm in 3048mm (1/4” in 10") when tested with a straightedge. Surface shall not contain irregularities that affect drainage, create puddles created than 2 ft^2.

3.3 APPLICATION OF PAVEMENT LINE MARKINGS

.1 Clean pavement surface in accordance with paint manufacturers written instructions.

.2 Paint lines straight and in uniform width, at locations indicated on drawings.

.3 Apply paint using marking machine or line stencil, and as recommended by manufacturer, to minimum 0.18mm (0.007") dry film thickness.

.4 Line Width: Roadways and Parking Areas: As indicated on Drawings.

3.4 CLEANING

.1 Remove spillage and over-spray of paint from pavement, sidewalks, building and other site features. Use methods and materials without damaging and leaving visible residue on substrates.

3.5 PROTECTION OF COMPLETED WORK

.1 Keep traffic off pavement markings for a time as recommended by paint manufacturer.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes the following:

.1 Permeable Concrete Pavers

.2 Permeable Joint Opening Aggregate

.3 Permeable Joint Aggregate Type 1

.4 Permeable Joint Aggregate Type 2

.5 Permeable Setting Bed Aggregate (Open-graded)

.6 Permeable Base Aggregate (Open-graded)

.7 Permeable Subbase Aggregate (Open-graded)

1.2 RELATED SECTIONS

.1 Section 31 22 13 Rough Grading

.2 Section 32 17 23 Pavement Markings

1.3 REFERENCES

.1 ASTM International, latest edition:

.1 C 29 Bulk Density and Voids in Aggregate Materials.

.2 C 33, Standard Specification for Concrete Aggregates.

.3 C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8, Freezing and Thawing.

.4 C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

.6 C 144 Standard Specifications for Aggregate for Masonry Mortar.

.7 D 448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

.8 C 936, Standard Specification for Solid Concrete Interlocking Paving Units.

.9 C 979, Standard Specification for Pigments for Integrally Colored Concrete.

.10 D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.

.11 D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10 lb (44.5 N) Rammer and 18 in. (457 mm) drop.

.12 C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units

.13 D 1883, Test Method for California Bearing Ratio of Laboratory-Compacted Soils.

.14 D 2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports.

.15 D 4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

1.4 SUBMITTALS

.1 Permeable Concrete Pavers:

.1 Samples for verification: Three representative full-size samples of each paver type, thickness, color and finish that indicate the range of color variation and texture expected upon project completion.

.2 Accepted samples become the standard of acceptance for the product produced.

.3 Test results from an independent testing laboratory for compliance of concrete pavers with ASTM C 936.

.4 Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.

.2 Permeable Joint Opening Aggregate:

.1 Provide three representative one pound samples in containers of aggregate materials that indicate the range of color variation and texture expected upon project completion.

.2 Accepted samples become the standard of acceptance for the product produced.

.3 Test results from an independent testing laboratory for sieve analysis, including washed gradations per ASTM C 136.

.4 Test results for void space percentage per ASTM C 29.

.3 Permeable Setting Bed, Base and Subbase Aggregate:

.1 Test results from an independent testing laboratory for compliance with ASTM D 448 No. 8, No. 57 and No. 2.

.2 Test results from an independent testing laboratory for sieve analysis, including washed gradations per ASTM C 136.

.3 Test results for void space percentage per ASTM C 29.

.4 Paving Installation Contractor:

.1 Job references from a minimum of three projects similar in size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

1.5 QUALITY ASSURANCE

.1 Utilize a Manufacturer having at least ten years of experience manufacturing interlocking concrete pavers on projects of similar nature or project size.

.2 Source Limitations:

.1 Obtain Permeable Concrete Pavers from one source location with the resources to provide products of consistent quality in appearance and physical properties.

.2 Obtain Permeable Joint Opening Aggregate from one source with the resources to provide materials and products of consistent quality in appearance and physical properties.

.3 Paving Contractor Qualifications:

.1 Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.

.4 Mockups:

.1 Install a 1.5 m x 1.5 m paver area.

.2 Use this area to determine joint sizes, lines, laying pattern(s) and levelness. This area will serve as the standard by which the workmanship will be judged.

.3 Subject to acceptance by owner, mock-up may be retained as part of finished work.

.4 If mock-up is not retained, haul offsite and dispose legally.

1.6 DELIVERY, STORAGE & HANDLING

.1 In accordance with Conditions of the Contract and Division 1 Common Product Requirements Section.

.2 Deliver Permeable Precast Concrete Pavers in manufacturer's original, unopened and undamaged container packaging with identification labels intact.

.1 Coordinate delivery and paving schedule to minimize interference with normal use of streets and sidewalks adjacent to paver installation.

.2 Deliver concrete pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.

.3 Unload pavers at job site in such a manner that no damage occurs to the product or adjacent surfaces.

.3 Store and protect materials free from mud, dirt and other foreign materials.

1.7 PROJECT/SITE CONDITIONS

.1 Environmental Requirements:

.1 Install permeable pavers only on unfrozen permeable setting bed aggregate materials.

.2 Install permeable setting bed only on unfrozen permeable base and subbase aggregates.

.3 Install permeable base or subbase aggregates only over unfrozen subgrade.

1.8 PERMEABLE CONCRETE PAVER OVERAGE AND ATTIC STOCK

.1 Provide a minimum of 5% additional material for overage to be used during construction.

.2 Furnish 30 square meters of each product and size used to owner for maintenance and repair. Furnish Permeable Concrete Pavers from the same production run as installed materials.

.3 Manufacturer to supply maintenance and reinstatement manuals for Permeable Precast Concrete Paver units.

2 Products

2.1 PERMEABLE CONCRETE PAVERS

.1 Basis-of-Design Product: The permeable concrete paver shapes are based on:

.1 Unilock:

.1 Eco- Optiloc

.2 As manufactured by:

Unilock

287 Armstrong Ave.

Georgetown, Ontario L7G 4X6

Contact: John Lavoie, 519 580-6265

.2 Product requirements:

.1 Permeable Paver Type 1: Unilock Eco-Optiloc for the field

.1 Color: Natural

.2 Finish:

.1 Standard

.3 Edge: Chamfer - 3 mm bevel

.4 Size: Manufacture the sizes indicated with a maximum tolerance of plus or minus 1/16 in all directions.

.1 260 mm (101/4 in) x 260 mm (101/4 in) x 80 mm (3-1/8 in) thick

Note: Imperial dimensions are nominal equivalents to the metric dimensions.

.2 Permeable Paver Type 2: Unilock Eco-Optiloc for the parking stall lines and pedestrian walking surfaces between parking stalls and to the entrance breezeway.

.1 Color: Charcoal

.2 Finish: Standard

.3 Edge: Chamfer - 3 mm rolled

.4 Size: Manufacture the sizes indicated with a maximum tolerance of plus or minus 1/16 in all directions.

.1 260 mm (101/4 in) x 260 mm (101/4 in) x 80 mm (3-1/8 in) thick

Note: Imperial dimensions are nominal equivalents to the metric dimensions.

.3 Provide pavers meeting the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence is not a cause for rejection.

.1 Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).

.2 Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.

.3 Resistance to 50 freeze-thaw cycles, when tested according to ASTM C1645, with no breakage greater than 1.0% loss in dry weight of any individual unit. Conduct this test method not more than 12 months prior to delivery of units.

.4 Accept only pigments in concrete pavers conforming to ASTM C 979.

Note: ACI Report No. 212.3R provides guidance on the use of pigments.

.5 Maximum allowable breakage of product is 5%.

2.2 PERMEABLE JOINT OPENING AGGREGATE

.1 Provide Permeable Joint Opening Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 8 as shown in Table 1.

**TABLE 1 - ECO-OPTILOC
PERMEABLE JOINT OPENING AGGREGATE
GRADATION REQUIREMENTS
(CRUSHED LIMESTONE)**

ASTM No. 8	
Sieve Size	**Percent Passing**
1/4 in (6 mm)	97 to 100
No. 4 (4.75 mm)	70 to 83
No. 8 (2.36 mm)	37 to 50
No. 16 (1.18 mm)	0 to 12

2.3 PERMEABLE SETTING BED AGGREGATE

.1 Provide Permeable Setting Bed Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 8 as presented in Table 2.

TABLE 2
PERMEABLE SETTING BED AGGREGATE
GRADATION REQUIREMENTS

ASTM No. 8	
Sieve Size	**Percent Passing**
½ in (12.5 mm)	100
3/8 in (9.5 mm)	85 to 100
No. 4 (4.75 mm)	10 to 30
No. 8 (2.36 mm)	0 to 10
No. 16 (1.18 mm)	0 to 5

2.4 PERMEABLE BASE AGGREGATE

.1 Provide Permeable Base Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 57 as presented in Table 3.

TABLE 3
PERMEABLE BASE AGGREGATE
GRADATION REQUIREMENTS

ASTM No. 57	
Sieve Size	**Percent Passing**
1-1/2 in (37.5 mm)	100
1 in (25 mm)	95 to 100
1/2 in (12.5 mm)	25 to 60
No. 4 (4.75 mm)	0 to 10
No. 8 (2.36 mm)	0 to 5

2.5 PERMEABLE SUBBASE AGGREGATE

.1 Provide Permeable Subbase Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 2 as presented in Table 4.

TABLE 4
PERMEABLE SUBBASE AGGREGATE
GRADATION REQUIREMENTS

ASTM No. 2	
Sieve Size	**Percent Passing**
3 in (75 mm)	100
2-1/2 in (63 mm)	90 to 100
2 in (50 mm)	35 to 70
1-1/2 in (37.5 mm)	0 to 15
3/4 (19 mm)	0 to 5

Note: For all aggregates, provide washed, clean, have zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials used in the construction of permeable pavement. Aggregate materials serve as the structural load bearing platform of the pavement as well as a temporary receptor for the infiltrated water that is collected through the openings in the pavement's surface.

2.6 EDGE RESTRAINTS

.1 Metal Edge Restraints:

.1 Permaloc, www.permaloc.com

.1 Material Type: Aluminum

.2 Model No.: 100 mm GeoEdge capture plate and geogrid

3 Execution

3.1 EXAMINATION

.1 Examine areas indicated to receive paving for compliance with requirements for installation tolerances and other conditions affecting performance for the following items before placing the Permeable Concrete Pavers.

.1 Verify that subgrade preparation, compacted density and elevations conform to specified requirements.

.2 Verify that Geotextiles, if applicable, have been placed according to drawings and specifications.

.3 Verify that Permeable Base and Subbase Aggregate materials, thickness, compacted density, surface tolerances and elevations conform to specified requirements.

.4 Provide written density test results for soil subgrade, Permeable Base and Subbase Aggregate materials to the Owner, General Contractor and paver installation subcontractor.

.5 Verify location, type, and elevations of edge restraints, concrete collars around utility structures, and drainage inlets.

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

.1 Beginning of bedding sand and paver installation signifies acceptance of base and edge restraints.

3.2 PREPARATION

.1 Verify that the subgrade soil is free from standing water.

.2 Stockpile Permeable Setting Bed, Joint, Base and Subbase Aggregate materials such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.

.3 Remove any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities before placing the Geotextile and Permeable Subbase Aggregate materials.

.4 Keep area where pavement is to be constructed free from sediment during entire job. Remove and replace all Geotextile, Permeable Joint, Setting Bed, Base and Subbase Aggregate materials contaminated with sediment with clean materials.

.5 Complete all subdrainage of underground services within the pavement area in conjunction with subgrade preparation and before the commencement of Permeable Subbase Aggregate construction.

.6 Prevent damage to underdrain pipes, overflow pipes, observation wells, or inlets and other drainage appurtenances during installation. Report all damage immediately.

.7 Compact soil subgrade uniformly to 95 percent of Standard Proctor Density per ASTM D 698 for pedestrian areas. Compact soil subgrade uniformly to 95 percent Modified Proctor per ASTM D 1557 for vehicular areas.

.8 Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting and replace with compacted backfill or fill as directed.

.9 Base compaction and proof-rolling of the subgrade soil on the recommendations of the Design Engineer. Request the Architect/Engineer to inspect subgrade preparations, elevations and conduct density tests for conformance to specifications.

3.3 INSTALLATION

.1 Edge Restraints

.1 Provide edge restraints as indicated.

.1 Provide metal edge restraints as indicated.

.2 Provide metal edge restraints along the perimeter of all paving as indicated and supported on a minimum of 150 mm of Base Aggregate.

.3 Provide 250 mm long spiral galvanized or stainless steel spike to fasten metal edge restraint at 600 mm on center for straight sections and 300 mm on center for curved sections.

.2 Permeable Base and Subbase Aggregate

.3 Provide the Permeable Subbase Aggregate in uniform lifts not exceeding 150 mm loose thickness and compact to at least 95 percent as per ASTM D 4254 to depths as indicated.

.4 Compact the Permeable Subbase Aggregate material with at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 ton vibratory roller until there is no visible movement. Do not crush aggregate with the roller.

.5 Tolerance: Do not exceed the specified surface grade of the compacted Permeable Subbase Aggregate material more than 20 mm over a 3 m long straightedge laid in any direction.

.6 Provide the Permeable Base Aggregate material in uniform lifts not exceeding 150 mm over the compacted Permeable Subbase Aggregate material and compact to at least 95 percent as per ASTM D 4254 to depths as indicated.

.7 Compact the Permeable Base Aggregate material with at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 ton vibratory roller until there is no visible movement. Do not crush aggregate with the compaction device.

.8 Tolerance: Do not exceed the specified surface grade of the compacted Permeable Base Aggregate material more than 13 mm over a 3 m long straightedge laid in any direction.

.9 Grade and compact the upper surface of the Permeable Base Aggregate material sufficiently to prevent infiltration of the Permeable Setting Bed Aggregate material both during construction and throughout its service life.

.2 Permeable Setting Bed Aggregate

.1 Provide and spread Permeable Setting Bed aggregate evenly over the Permeable Base Aggregate course and screed to a nominal thickness of 40 mm.

.2 Protect screeded Permeable Setting Bed Aggregate from being disturbed.

.3 Screed only the area which can be covered by pavers in one day.

.4 Do not use Permeable Setting Bed Aggregate material to fill depressions in the base surface.

.5 Keep moisture content constant and density loose and constant until Concrete Pavers are set and compacted.

.6 Inspect the Permeable Setting Bed Aggregate course prior to commencing the placement of the permeable concrete pavers.

.7 Inspect the Setting Bed Aggregate course prior to commencing the placement of the Permeable Concrete Pavers. Acceptance of the Setting Bed Aggregate occurs with the initiation of Permeable Concrete Paver placement.

.3 Permeable Concrete Pavers

.1 Replace unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.

.2 Mix Concrete Pavers from a minimum of three (3) bundles simultaneously drawing the paver vertically rather than horizontally, as they are placed, to produce uniform blend of colors and textures. (Color variation occurs with all concrete products. This phenomenon is influenced by a variety of factors, e.g. moisture content, curing conditions, different aggregates and, most commonly, from different production runs. By installing from a minimum of three (3) bundles simultaneously, variation in color is dispersed and blended throughout the project).

.3 Exercise care in handling face mix pavers to prevent surfaces from contacting backs or edges of other units.

.4 Provide Permeable Concrete Pavers using joint pattern as indicated. Adjust joint pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers exposed to vehicular tires no smaller than one-third of a whole paver.

.5 Use string lines or chalk lines on Permeable Setting Bed aggregate to hold all pattern lines true.

.6 Set surface elevation of pavers 3 mm above adjacent drainage inlets, concrete collars or channels.

.7 Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.

.1 When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

.8 Provide space between paver units of 1 mm wide to achieve straight bond lines.

.9 Prevent joint (bond) lines from shifting more than ±15 mm over 15 m from string lines.

.10 Fill gaps between units or at edges of the paved area that exceed 10 mm with pieces cut to fit from full-size unit pavers.

.11 Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

.12 Prevent all traffic on installed pavers until Permeable Joint Aggregate has been vibrated into joints. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and Permeable Joint Aggregate material. .

.13 Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:

.1 After edge pavers are installed and there is a completed surface.

.2 Compact installed concrete pavers to within 1,800 mm of the laying face before ending each day's work. Cover pavers that have not been compacted and leveling course on which pavers have not been placed, with nonstaining plastic sheets to prevent Permeable Setting Bed Aggregate from becoming disturbed.

.14 Protect face mix Concrete Paver surface from scuffing during compaction by utilizing a urethane pad.

.15 Remove any cracked or structurally damaged pavers and replace with new units prior to installing Permeable Joint Opening Aggregate material.

.16 Provide, spread and sweep Permeable Joint Opening Aggregate into joints immediately after vibrating pavers into Permeable Setting Bed course until full. Vibrate pavers and add Permeable Joint Aggregate material until joints are completely filled, then remove excess material. This will require at least 4 passes with a plate compactor.

.17 Remove excess Permeable Joint Aggregate broom clean from surface when installation is complete.

3.4 FIELD QUALITY CONTROL

.1 Verify final elevations for conformance to the drawings after sweeping the surface clean.

.1 Prevent final Concrete Paver finished grade elevations from deviating more than ±10 mm under a 3 m straightedge or indicated slope, for finished surface of paving.

.2 Lippage: No greater than 0.8 mm difference in height between Permeable Concrete Pavers and adjacent paved surfaces.

3.5 REPAIRING, CLEANING AND SEALING

.1 Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

.2 Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed paver surfaces; wash and scrub clean.

.1 Clean Permeable Concrete Pavers in accordance with the manufacturer's written recommendations.

3.6 PROTECTION

.1 Protect completed work from damage due to subsequent construction activity on the site.

3.7 PERMEABLE JOINT AGGREGATE MATERIAL REFILLING

.1 Remove all debris from joint and provide additional Permeable Joint Aggregate material after 120 days and before 150 days after date of Substantial Completion/Provisional Acceptance.

.1 Fill Permeable Joint Aggregate material full to the lip of the paver.

3.8 LIFE CYCLE ACTIVITIES

.1 Paver cleaning: Clean Permeable Concrete Pavers as needed to remove staining, dirt, debris, etc.

.1 Clean per manufacturers recommendations.

.2 Maintenance: Permeable Joint Aggregate Material.

.1 Annually inspect Permeable Joint Aggregate material for areas clogged with debris.

.2 Vacuum or sweep as necessary to restore surface infiltration.

.3 Remove debris by vacuuming or sweeping Permeable Joint Aggregate

.3 Replenish removed Permeable Joint Aggregate material with clean aggregate material flush to paver lip.

.4 Sweep excess material from paver surface.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply and installation of concrete and to form curbs and sidewalks, as indicated in this Section.

1.2 RELATED REQUIREMENTS

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

.2 Section 03 35 00 Concrete Finishing

.3 Section 31 23 33 Excavation, Trenching and Backfilling

.4 Section 32 12 16 Asphalt Paving for Parking Lots and Driveways

.5 Section 32 14 13 Permeable Precast Concrete Paving Materials

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

.2 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

.3 ASTM D1752-04a(2008): Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

.2 Canadian Standards Association (CSA)

.1 CSA A23.1-09/23.2-09: Concrete Materials and Methods of Concrete Construction/Test methods and Standard Practices for Concrete

.2 CSA G30.18-09: Carbon Steel Bars for Concrete Reinforcement

.3 CAN/CSA B651-04(R2010): Accessible Design for the Built Environment

2 Products

2.1 MATERIALS

.1 Granular Base:

.1 Conforming to OPSS Form No. 1010, Class 'A' aggregate:

Sieve Designation	% Passing by Dry Weight
Imperial	
22mm (7/8")	100
16mm (5/8")	75 - 100
13mm (1/2")	65 - 90
No. 4	35 - 55
No. 16	15 - 45
No. 50	5 - 22
No. 200	0 - 8

.2 Forms:

.1 Form Materials: Plywood, metal, metal framed plywood, or other acceptable panel type materials to provide full depth, continuous, straight, smooth exposed surfaces.

.2 Use flexible or curved forms for curves with a radius of 30m or less.

.3 Form Release Agent: Commercially formulated form release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

.3 Steel Reinforcement:

.1 Plain Steel Welded Wire Reinforcement: Meeting the requirements of ASTM A185, fabricated from as-drawn steel wire into flat sheets.

.2 Deformed Steel Welded Wire Reinforcement: Meeting the requirements of ASTM A497, flat sheet.

.3 Reinforcing Bars: Deformed bars, meeting requirements of CSA G30.18, and Grade meeting requirements of Structural Engineer. Dowels and Tie-Bars: Smooth or deformed bars, meeting requirements of CSA G30.18, Grade meeting requirements of Structural Engineer, and as follows:

.1 Dowels:

.1 Plain round bars, clean, straight and free from flattened or burred ends.

.2 Dowels for contraction joints shall be in rigid assemblies of required dimension and spacing and held in the middle of the slab depth to proper horizontal and vertical alignment.

.2 Tie-Bars: Deformed steel bars.

.4 Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place, fabricated from steel wire, plastic, or precast concrete of greater compressive strength than concrete; equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

.4 Concrete Materials:

.1 Cement Type: Normal Portland Cement in accordance with CSA A3000, Type GU.

.2 Concrete Admixtures: Certified by manufacturer to contain a maximum of 0.1% water-soluble chloride ions by mass of cementitious material and being compatible with other admixtures and cementitious materials; do not use admixtures containing calcium chloride:

.1 Corrosion Inhibiting Admixture:

.1 Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

.2 Acceptable materials: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

.1 FerroGard-901; Sika Corporation.

.2 DCI or DCI-S; Grace Construction Materials.

.3 Rheocrete 222+; BASF

.5 Water: Meeting requirements of CSA A23.1/A23.2.

.6 Concrete Aggregate: Meeting requirements of CSA A23.1/A23.2, containing no shale, and as follows:

.1 Normal Density Fine Aggregate: Nominal maximum aggregate size in accordance with CSA A23.2-1A, uniformly graded to maintain Workability and control water bleed out, as indicated on Drawings.

.2 Normal Density Coarse Aggregate: Aggregate selected from Group I or Group II Grading Classifications, to suit design mix, in accordance with CSA A23.2-13A, nominal maximum aggregate sizes and applications as indicated on Drawings.

.7 Expansion and Isolation Joint Filler Strips: Meeting requirements of ASTM D1751, asphalt saturated cellulose fibre.

.8 Curing Materials:

.1 Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 300 g/m^2 dry weight.

.2 Moisture Retaining Cover: ASTM C171, polyethylene film or white burlap polyethylene sheet.

.3 Water: Potable.

.4 Curing and Sealing Compound: Ultra-violet light resistant, non-yellowing acrylic polymer/water based type curing and sealing compound conforming to ASTM C309-93, Type 1, Class B, 'Sealtight VOCOMP-20' by W.R. Meadows of Canada Limited, or 'Florseal W.B.' by Sika Canada Inc., or approved equal.

3 Execution

3.1 PREPARATION

.1 Set out work from lines and levels shown on drawings.

.2 Fine grade, shape and compact subgrade to minimum of 98% Standard Proctor Density.

3.2 INSTALLATION

.1 Concrete Curbs:

.1 Align concrete curbs with curves and tangents as shown on drawings. The minimum overall depth shall be 457mm (18") with a curb face of 150mm (6") as shown on drawings.

.2 Obtain approval of forms from Consultant before pouring concrete.

.3 Side forms shall be of nominal 50mm (2") thick lumber, free of warp, and properly supported to maintain alignment and grade, except on curved sections where nominal 25mm (1") lumber may be used. Treat all form lumber with a non-staining mineral oil prior to concrete placement. Construct form to prevent honeycombing.

.4 Curbs shall have expansion joints of asphalt plank at 4.5 m to 6.0 m intervals. Place a reinforcing bar at top and base of curb, with concrete coverage of 50mm (2") minimum.

.2 Sidewalks:

.1 Place granular base immediately after the subgrade is approved by the Consultant, to 150mm (6") compacted thickness.

.2 Fine grade, shape and compact each layer to a minimum of 98% Standard Proctor Density.

.3 Maintain true grade and cross section for each layer of material.

.4 Place asphalt planks at locations as indicated on drawings to form expansion joints at maximum of 4.5 m to 6.0 m (15' to 20') intervals with dummy joints at 1524 mm (5') O/C or as noted on drawings.

.5 Place welded wire mesh 38mm (1-1/2") from top surface of concrete or as noted on details. Lap mesh mats 150mm (6") and tie securely.

.3 Concrete:

.1 Pour concrete on prepared granular base to required levels and dimensions. Execute work in accordance with CAN/CSA-A23.1/A23.2.

.2 Do not deposit concrete on frozen ground. When deposited in forms concrete shall have a temperature between 10 deg.C and 30 deg.C and these limits shall be maintained for 72 hours.

.3 Fill forms with an excess of concrete and, after compacting strike to the required level in such a manner as to force the course aggregate below the mortar surface; finish top surface with a wood float to an even, smooth, dense surface.

.4 Do not strip forms for 24 hours after pouring concrete.

.5 After finishing and after stripping the forms, treat surfaces with approved curing compound.

.6 By means acceptable to the Consultant protect concrete from harmful effects of sunshine, drying winds and cold running of surface water for a minimum period of 5 days.

.4 Curb Finishes:

.1 Curb finish edges of dummy joints and expansion joints with 6mm (1/4") radius edging tool.

.2 Sidewalk concrete shall have a broom finish, employing a stiff broom, to produce an even, "non-slip" surface.

.3 Form intermediate dummy joints with a trowel cut. Edges of dummy joints and expansion joints shall be finished with a 6mm (1/4") radius edging tool.

.4 Provide concrete curb cuts and sidewalk handicap access ramps as indicated in accordance with CAN/CSA-B651 and the authorities having jurisdiction.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 12 16 Asphalt Paving for Parking Lots and Driveways

.2 Section 03 30 00 Cast in Place Concrete

1.2 REFERENCES

.1 CAN/CGSB 1.74, Alkyd Traffic Paint.

.2 FED-STD 595B, Standard Paint Colours.

.3 OPSS 1712, Material Specification for Organic Solvent Based Traffic Paint.

.4 Environment Canada (EC)

.1 Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations, SOR/2009-264.

.5 Green Seal (GS)

.1 GS-11-2013, Standard for Paints and Coatings.

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

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

1.4 QUALITY ASSURANCE

.1 Applicator's qualifications: Perform Work of this Section by a company approved by manufacturer and having specialized equipment suitable for type of work specified.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operations and Maintenance Data: submit information on materials relative to work of this Section for inclusion in operations and maintenance manual.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Sustainable Design Provisions:

.1 Seasonal restriction for high VOC content traffic marking coatings.

.1 Do not install Work of this Section outside of following environmental requirements without manufacturer's written acceptance:

.2 Traffic paint: Ambient air and surface temperature minimum 5°C and maximum 43°C. Maximum relative humidity 85%, wind speed is less than 60 km/h and no forecast of rain within 4 h of start of application.

.3 Traffic marking coating application between May 1st and October 15th is subject to seasonal use restriction and must not have a VOC concentration in excess of 150 g/L.

2 Products

2.1 MATERIALS

.1 Paint and Markings:

.1 Organic solvent based, lead-free to OPSS 1712 or CAN/CGSB 1.74.

.2 Paints: in accordance with Master Painter Institute (MPI) recommendation for surface conditions.

.3 Colour: to MPI listed, white lines at pedestrian crosswalk, directional arrows and activity areas, white border and international symbol and blue background for accessible parking pavement markings.

3 Execution

3.1 EXAMINATION AND PREPARATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.

.1 Visually inspect substrate in presence of Parks Canada Departmental Representative and/or Consultant.

.2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.

.3 Clean pavement surface and remove loose material.

.4 Prohibit traffic in work area, until Work of this Section is complete.

.5 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

.1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

.2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.

3.3 APPLICATION

.1 Pavement markings: lay out traffic lines and markings as indicated on the drawings and in accordance with manufacturer’s instructions.

.2 Unless otherwise approved by Parks Canada Departmental Representative and the Consultant, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.

.3 Apply traffic paint evenly at rate of 3 m^2/L (150 sq. ft/gal).

.4 Do not thin paint unless approved by Parks Canada Departmental Representative or Consultant.

.5 Symbols and letters to dimensions indicated.

.6 Provide adequate shielding or masking during spray application of traffic paint.

.7 Paint lines of uniform colour and density with sharp edges. Lines shall be of uniform colour and density. Paint markings to be within plus or minus 12 mm of dimensions indicated.

.8 Thoroughly clean distributor tank before refilling with paint of different colour.

3.4 TOLERANCE

.1 Paint markings: within plus or minus 12 mm of dimensions indicated.

.2 Refinish ragged edges or lines incorrectly laid out. Remove incorrect lines. Make inconspicuous.

3.5 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.6 PROTECTION

.1 Supply and install temporary barricades and traffic cones to protect freshly painted line work from being marked or otherwise disturbed until after paint is dry.

.2 Repair damage to adjacent materials caused by pavement marking application.

.3 Supply and install temporary barricades and traffic cones to protect freshly painted line Work from being marked or otherwise disturbed until after paint is dry.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section specifies the supply and installation of exterior site furnishings.

1.2 RELATED SECTIONS

.1 Section 03 30 00 Plain Concrete Paving

1.3 REFERENCES

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

.1 ASTM B117-11, “Standard Practice for Operating Salt Spray (Fog) Apparatus”.

.2 ASTM D522-13, “Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings”.

.3 ASTM D523-14, “Standard Test Method for Specular Gloss”.

.4 ASTM D2247-11, “Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity”.

.5 ASTM D2794-93 (R2010), “Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)”.

.6 ASTM D3359-09, “Standard Test Methods for Measuring Adhesion by Tape Test”.

.7 ASTM D3363-05 (R2011), “Standard Test Method for Film Hardness by Pencil Test”.

.8 ASTM G155-13, “Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials”.

.2 International Organization for Standardization (ISO):

.1 ISO 1520:2006, Paints and Varnishes-Cupping Test.

.2 ISO 2815:2003, Paints and Varnishes-Buchholz Indentation Test.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

1.5 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for care and cleaning of site furnishings for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Manufacturer will confirm supply of spare parts for replacement purposes.

1.6 QUALITY ASSURANCE

.1 Sustainable Standards Certification:

.1 Certified Wood: Submit listing of wood products and materials used in accordance with FSC or SFI.

1.7 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect furnishings from nicks, scratches and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: Remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

1.8 WARRANTY

.1 Products will be free from defects in material and workmanship for a period of three (3) years from the date of invoice.

.2 The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence or abuse.

.3 Site furnishing supplier shall repair, replace or refund the purchase price of any items found defective upon inspection by an authorized supplier service representative.

.4 Purchasers should be aware that normal use of these high quality products can result in superficial damage affecting the finish. Scratches, nicks and dents are to be considered normal wear and tear and are not the responsibility of the manufacturer.

2 Products

2.1 FURNISHINGS

.1 Pedestal table: **to be purchased and installed by Parks Canada.**

.1 Paris SGL pedestal table, surface mount, Model #: PPC-4PS-SURF(462-053).

.1 Anchor bolts: Corrosion register, sleeve anchors.

.2 Color shall be Graphite Grey.

.3 Umbrellas shall be supplied by Sherris Living Large. 5440 Terracotta and 8015 Dupoine Laurel, **purchased and installed by Parks Canada.**

.2 Deck Chairs: **to be purchased and installed by Parks Canada.**

.3 Bicycle Rack:

.1 To be purchased and installed by Parks Canada.

.4 Basketball pole and hoop:

.1 Spalding 54” Acrylic Hercules Basketball System.

.2 Portable Standing:

.3 Colour: Black

.5 Concrete Ping Pong Tables:

.1 Stone Age Concrete Table Tennis (Ping Pong) supplied by Bravado Outdoor Products (541) 671-6318 or approved substitute.

.2 Finish available in an integrally dyed green and grey colour.

.6 Play structure components:

.1 Landscape Structures ® Evos 1 Arch with 4 attach points, Model # 171628, supplied by A.B.C. Recreation Ltd. (519) 754-5365

.1 Direct buried:

.2 Colour: Post: Cedar Brown and steel-reinforced cables: Cedar Green

.2 Landscape Structures ® Evos Swiggle stix Bridge, Model # 156450, supplied by A.B.C. Recreation Ltd. (519) 754-5365

.1 Direct buried:

.2 Colour: Post: Cedar Brown.

.3 Colour: Poly Pods: Cedar Green.

.3 Landscape Structures ® funnel net climber with two vertical ladders, Model #: 144477, supplied by A.B.C. Recreation Ltd. (519) 754-5365

.1 Direct buried:

.2 Color: Post: Cedar Brown; ladders: Cedar Green and steel-reinforced cables: Cedar Green.

.7 Propane Fire Pit: HPC EI Series Round Penta Burner Bowl Insert - 37". Supplied by Woodland Direct, 586-803-7292.

.8 Soccer Nets: QUICKSTER ®, Model #: 12X6 GOAL, supplied by SKLZ. (877) 225-7275

.1 Portable system: with steel ground stakes.

.9 Rubber Surface: Everplay “Poured in place recreation and play surface “(in situ) supplied by EVERPLAY Installation Inc. (416) 410-3056

.1 Colour: Light Beige 50%, Brown 50%

.10 Seating:

.1 Fire Pit

.1 OGM1900 – 80498 supplied by Maglin Site Furniture (519) 788-1939

.1 Surface mounted to cast in place concrete paving.

.2 Material: Recycled Plastic (HDPE).

.3 Colour: Brown (PBN).

.2 Amphitheatre

.1 OGM1900 – 80500 supplied by Maglin Site Furniture (519) 788-1939

.1 Surface mounted to cast in place concrete sono tubes.

.2 Materials: Recycled Plastic (HDPE).

.3 Colour: Brown (PBN).

.2 OGM1900 – 80501 supplied by Maglin Site Furniture (519) 788-1939

.1 Surface mounted to cast in place concrete sono tubes.

.2 Material: Recycled Plastic (HDPE).

.3 Colour: Brown (PBN).

.11 Water Feature:

.1 Submersible pump – OASE Pond pump 280 with adjustable flow control or approved equivalent.

.2 EPDM 45 mil pond liner.

.12 Steel Bollard:

.1 150 mm dia. 40 schedule pipe.

.2 EZ sleeve covering , 150 mm dia. colour yellow supplied by Strike Products 1 (800) 262-4129.

.13 Premium Rubber Wheel Stops: 1800 mm long, 150 mm wide, 100 mm high, yellow complete complete with HRDWR-3WS (set of 3) anchor hardware supplied by Barco Products Canada, 1 (855) 975-2573.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for exterior site furnishing installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

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

3.2 PREPARATION

.1 Locate and protect utility lines.

.2 Notify and acquire written acknowledgment from utility authorities before beginning installation work

3.3 INSTALLATION

.1 Assemble furnishings in accordance with manufacturer's written recommendations.

.2 Install furnishing true, plumb, anchored firmly supported, as indicated or directed by Consultant.

.3 Touch-up damaged finishes to approval of Consultant.

3.4 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

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

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by site furnishings installation.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section specifies requirements for placement of topsoil and grading work.

1.2 RELATED SECTIONS

.1 Section 32 92 19 Seeding

.2 Section 32 93 53 Planting of Trees, Shrubs and Ground Cover

1.3 REFERENCES

.1 Agriculture and Agri-Food Canada:

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment:

.1 PN1340-2005, Guidelines for Compost Quality.

.3 Canadian Nursery Landscape Association (CNLA):

.1 Canadian Standards for Nursery Stock, 8th Edition, 2006.

1.4 DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.

.2 Product will be sufficiently decomposed (i.e. stable) so that further decomposition does not adversely affect plant growth (C:N ratio below 25) and contain no toxic or growth inhibiting contaminates.

1.5 SUBMITTALS

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

.2 Quality control submittals:

.1 Soil testing: Submit certified test reports showing compliance with specified performance characteristics and physical properties as described in 2.3 below.

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

1.6 QUALITY ASSURANCE

.1 Pre-installation meetings: Conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

2 Products

2.1 TOPSOIL

.1 Topsoil for seeded areas mixture of particulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7% clay and contain 2 to 10% organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials.

.3 Finished surface free from:

.1 Debris and stones over 50 mm diameter; and

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.4 Consistence: Friable when moist.

2.2 SOIL AMENDMENTS

.1 Fertilizer:

.1 Fertility: Major soil nutrients present in following amounts:

.2 Nitrogen (N): Twenty (20) to forty (40) micrograms of available N per gram of topsoil;

.3 Phosphorus (P): forty (40) to fifty (50) micrograms of phosphate per gram of topsoil;

.4 Potassium (K): Seventy-five (75) to one-hundred-ten (110) micrograms of potassium per gram of topsoil;

.5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination/establishment of intended vegetation; and

.6 pH value: 6.5 to 8.0.

.2 Compost:

.1 Decomposing organic matter such as cow manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.2 Processed organic matter containing 40% (by dry weight) or more organic matter as determined by Walkley-Black or Loss on Ignition (LOI) test.

.3 Product will be sufficiently decomposed (i.e. stable) so that further decomposition does not adversely affect plant growth (C:N ratio below 25) and contain no toxic or growth inhibiting contaminates.

.4 Composted bio-solids to: CCME Guidelines for Compost Quality, Category A.

.3 Sand: Washed coarse silica sand, medium to course textured.

.4 Limestone:

.1 Ground agricultural limestone.

.2 Gradation requirements: Percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.5 Fertilizer: Industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

.1 Contractor is responsible for supplying and mixing the amendments to meet the requirements of 2.1 above and in accordance with recommendations from the Soil Tests.

.2 Soil testing by recognized testing facility for pH, P and K and organic matter.

.3 Testing of topsoil will be carried out by testing laboratory approved by Departmental Representative.

.1 Soil sampling, testing and analysis in accordance with Provincial standards.

.4 Take soil samples prior to topsoil stripping from areas to be stripped and cleared.

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, 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 PREPARATION OF SUBGRADE

.1 Verify that grades are correct.

.1 If discrepancies occur, notify Parks Canada Departmental Representative.

.2 Parks Canada Departmental Representative and do not commence work until instructed.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than 75 mm above surface.

.3 Dispose of removed material off-site.

.4 Loosen areas which are to receive topsoil, seed and plant material to a minimum depth of 25 mm.

.1 Prepare these areas to provide a continuous loose subgrade layer. Do not place topsoil until the subgrade layer has been accepted by the Department Representative. Placing topsoil on a compacted subgrade will be rejected.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place screened imported topsoil after Parks Canada Departmental Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 For seeded areas keep subsoil 15 mm below finished grade.

.4 Spread topsoil to the following minimum depths after settlement:

.1 150 mm deep for seeded areas;

.2 900 mm deep for tree pits. Excavate and provide 6.0 m^3 of topsoil per tree pit. This requirement supersedes other standard tree pit details that may be shown in this Contract; and

.3 450 mm deep of triple mix in a continuous layer for shrub beds. This requirement supersedes other standard shrub planting details that may be shown in this Contract.

.5 Manually spread topsoil around trees, shrubs and obstacles.

3.4 SOIL AMENDMENTS

.1 Thoroughly mix the recommended soil amendments, recommended in the Soil Testing Report into the full specified depth of the topsoil.

3.5 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Parks Canada Departmental Representative.

.3 Leave surfaces smooth, uniform and firm against deep foot printing.

3.6 ACCEPTANCE

.1 Parks Canada Departmental Representative and consultant will inspect topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.7 SURPLUS MATERIAL

.1 Dispose of materials that are not required off-site. Retain excess topsoil on-site or as directed by Parks Canada Departmental Representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section specifies the requirements for mechanical seeding.

1.2 RELATED SECTIONS

.1 Section 32 91 19 Topsoil Placement and Grading

.2 Section 32 93 10 Landscape Maintenance

1.3 REFERENCES

.1 Canadian Nursery Landscape Association (CNLA):

.1 Canadian Standards for Nursery Stock, 8th Edition, 2006.

.2 Canada Seeds Act (Current Version).

.3 Canada Fertilizer Act (Current Version).

1.4 SUBMITTALS

.1 Product Data:

.1 Submit product data in accordance with 01 33 00 Submittal Procedures.

.2 Provide product data for mechanically applied seeding:

.1 Seed.

.2 Fertilizer.

.3 Erosion Control Blanket.

1.5 QUALITY ASSURANCE

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

.1 Seed supplied either as a single seed species or as a seed mix will comply with the provisions of the Canada Seed Act and Regulations and the grade standards for the specific seed species.

.2 Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

.3 Seed packaging, labelling and storage will be in accordance with Canada Seed Act and Regulations. Make arrangements for inspection and approval of seed mixtures by Departmental Representative prior to installation.

1.6 SCHEDULING

.1 Schedule mechanical seeding to coincide with preparation of soil surface.

.2 For optimum conditions, schedule seeding from May 1 to June 15 or August 15 to October 15.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Divert unused fertilizer from landfill to official hazardous material collections site.

.3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

2 Products

2.1 MATERIALS

.1 Seed: “Canada pedigreed grade” in accordance with Government of Canada Seeds Act and Regulations.

.1 Pollinator and Pro Sport Field Seed Mixes.

.1 Seed Mix Types are defined on L-10 in the drawing package.

.2 Seeding Rate: as noted on L-10 in the drawing package.

.3 Water: Free of impurities that would inhibit germination and growth.

.4 Fertilizer:

.1 To Canada “Fertilizers Act” and “Fertilizers Regulations”.

.2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

.5 Erosion Control Blanket:

.1 Bio degradable erosion control blanket.

3 Execution

3.1 WORKMANSHIP

.1 Do not perform work under adverse field conditions such as high winds, frozen ground or ground covered with snow, ice or standing water.

.2 Protect seeded areas from trespass until plants are established.

.3 See landscape drawings for extents of Pollinator and Pro Sports Field Seed mixes.

3.2 SEED PLACEMENT

.1 All seed mixes shall be applied per the application rates specified in the Drawings using a broadcast method or drill seeder seeding method.

.2 Sow seed uniformly on a cultivated surface, per Section 3.2.

3.3 MANUAL/ MECHANICAL SEEDING

.1 For mechanical (drill) seeding:

.1 Use "Brillion" type mechanical landscape seeder which accurately places seed at specified depth and rate and rolls in single operation.

.2 Use equipment and method acceptable to Parks Canada Departmental Representative.

.2 For manual seeding:

.1 Use "Cyclone" type manually operated seeder. Hand-held type is appropriate for small areas inaccessible to equipment.

.2 Use manually operated, water ballast, landscaping type, smooth steel drum roller.

.3 Ballast as directed by Parks Canada Departmental Representative.

.3 When using a manual seeding method, sow half of required amount of seed in one direction and remainder at right angles as applicable.

.4 Blend applications 150 mm into adjacent grass areas and/or previous applications to form uniform surfaces.

.5 Consolidate mechanically seeded areas by rolling area if soil conditions warrant or if directed by Parks Canada Departmental Representative with equipment approved by Parks Canada Departmental Representative immediately after seeding.

3.4 PREPARATION OF SURFACES

.1 Fine grade areas being seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.

.2 Cultivate areas to receive seed mixes to a depth of 50 mm min. Ensure areas being seeded are moist to depth of 150 mm before seeding.

.3 Obtain Parks Canada Departmental Representative approval of grade and topsoil depth before starting to seed.

.4 Placement of topsoil to comply with Section 32 91 19 Topsoil Placement and Grading.

3.5 FERTILIZING PROGRAM

.1 Supply and install 8-32-16 fertilizer at 350 kg per hectare in accordance with OPSS 804. Contractor to submit the application approach two (2) weeks in advance of application for review and approval by Parks Canada Departmental Representative

3.6 PROTECTION, EROSION CONTROL

.1 Erect, maintain and remove continuous temporary barrier fence to prevent traffic on newly seeded areas as directed by the Parks Canada Departmental Representative.

.2 Install biodegradable erosion control blanket on all seeded surfaces immediately after seeding.

3.7 PRELIMINARY ACCEPTANCE

.1 All areas seeded will be inspected by the Parks Canada Departmental Representative using the Seeding and Cover Quality Assurance Visual Inspection Field Guide to ensure compliance with this specification at 30, 60, and 90 Day periods following the seeding operation.

.1 At the 30 Day inspection within the seeded area:

.1 The applied cover shall be visually intact and shall form a uniform cohesive mat.

.2 Where applied, germination of the nurse crop shall be visually evident.

.2 At the 60 Day inspection within the seeded area:

.1 Where applied, the nurse crop shall be evident at mature height in an evenly dispersed, uniform cover.

.2 Germination of the specified permanent seed species shall be visually evident in an evenly dispersed uniform cover.

.3 There shall not be any significant bare areas, both in terms of quantity and size.

.4 Non-seeded, non-specified vegetation shall not exceed 20% of the seeded earth area

.3 At the 90 Day inspection within the seeded area:

.1 Germination of specified permanent seed species shall be visually evident in an evenly dispersed uniform cover at an average height of 50 mm for specified grasses. Slow germinating species and wildflowers may not be evident.

.2 There shall not be any significant bare areas, both in terms of quantity and size.

.3 Non-seeded, non-specified vegetation shall not exceed 20% of the seeded earth area

3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Grass Mixture:

.1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.

.2 Fertilize seeded areas ten (10) weeks after germination provided plants have mature true leaves in accordance with fertilizing program. Spread half of required amount of fertilizer in one (1) direction and remainder at right angles.

.3 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.

.4 Water seeded areas regularly during the first 6-8 weeks after planting to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent incidents of erosion.

3.9 FINAL ACCEPTANCE

.1 Seeded areas will be accepted by Parks Canada Departmental Representative provided that:

.1 Plants are uniformly established and seeded areas are free of rutted, eroded, bare or dead spots; and

.2 Areas have been fertilized.

.2 Areas seeded in fall will achieve final acceptance in following spring, one (1) month after start of growing season provided acceptance conditions are fulfilled.

3.10 MAINTENANCE DURING WARRANTY PERIOD

.1 Perform following operations from time of acceptance until end of warranty period:

.1 Repair and reseed dead or bare spots to satisfaction of Parks Canada Departmental Representative.

.2 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one (1) direction and remainder at right angles.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 32 93 53 Planting of Trees, Shrubs and Ground Cover

1.2 GENERAL

.1 Work Included: To carry out maintenance of seeded areas and plant material for the duration of the warranty period that extends one (1) year from the date of Substantial Performance of the Work. Refer to Section 32 93 00 – Planting of Trees, Shrubs and Ground Covers.

.1 Ensure health and vigor of seed

.2 Ensure health and vigor of trees, shrubs, and ground covers

.2 Default

.1 In the event that the landscape maintenance contractor fails to respond to maintenance and warranty requests within 14 days from the Departmental Representative's written notification, the defective work of this section shall be rectified at the landscape contractor's expense.

1.3 QUALIFICATION OF LANDSCAPE MAINTENANCE CONTRACTOR

.1 Maintenance work will be done by experienced, qualified personnel with at least five years of horticultural and planting experience.

1.4 MAINTENANCE INSPECTIONS AND REPORTING PROCEDURES

.1 The Work of this Section will be inspected by the Parks Canada Departmental Representative and the consultant on the anniversary of the first year of the maintenance period. A maintenance report will be provided to landscape maintenance contractor based on findings of inspection.

.2 Report in writing to the Parks Canada Departmental Representative the maintenance Work performed and a schedule of Work to be performed on a seasonal basis: Spring Report by May 1, Summer Report by September 1, and a Fall Report by November 1. Immediately report damages resulting from vandalism or other causes beyond the landscape contractor's control to the Parks Canada Departmental Representative.

.3 Make periodic inspections of plants and seeded areas during the maintenance period and notify the Parks Canada Departmental Representative in writing of preventative or corrective measures necessary to maintain the plants and seeded areas in good, healthy condition. Inspection of the Site will be carried out by the landscape maintenance contractor on a bi-weekly basis. Inspections will focus on assessment of plant vigour, grass density, weed growth to establish corrective measures, and other Site specific observations related to plant health.

.4 Coordinate all Work with the Parks Canada Departmental Representative to ensure that there is no interference with the operation and maintenance of the Site.

2 Products

Not Used

3 Execution

3.1 MAINTENANCE OF TREES, SHRUBS, GROUND COVERS AND SEEDED AREAS

.1 Include in the Work of this Section maintenance to ensure vigorous and healthy growth. Maintenance will consist of, but not be limited to, the following: pruning; cultivating; monthly weeding; fertilizing; mulching; watering; repair of trunk wrapping; securing of tree stakes; tightening of wires; resetting to proper grade or upright position; spraying to keep free of pests, insects and disease; and barriers to prevent damage by persons or animals. Thoroughly water

evergreens in late fall prior to freeze-up to saturate soil around root system. Reform damaged watering saucers.

.2 Remove unwanted vegetation from mulched planting beds during the maintenance period.

3.2 ADJUSTMENT AND REPLACEMENT

.1 Perform adjustment and replacement Work with materials of the same type and quality as outlined in the Contract Drawings and Section 32 93 53 – Planting of Trees, Shrubs and Ground Covers. Replacement Work will have a warranty of the same length and with the same conditions as outlined in Section 32 93 53 – Planting of Trees, Shrubs and Ground Covers. The landscape maintenance contractor shall provide a renewed warranty that starts from time of approval of the replacement work of this section.

.2 Replace plant stock that is dead, or not in a flourishing growing state, or does not meet the requirements set out in the Specifications. Remove dead stock immediately. Replace stock at the proper time during the next planting season. Tag or mark replacement material in a permanently visible manner, and notify the Consultant in writing of the date on which the replacement was planted. Include a sketch showing the location of replaced plants.

.3 After settlement has occurred at the planting pits, fill in to the specified grade with planting soil mixture.

3.3 WEED CONTROL

.1 Tree Pits, Planting Beds and seeded areas: Remove weeds from planting berm/saucer and planting bed mulch on a on a regular basis. Top up mulch to ensure 75 mm depth during the maintenance period.

.2 Application of herbicide to control grass growth around trees and planting beds shall be coordinated with a licensed herbicidal applicator. Any application of herbicide shall be confirmed with Consultant prior to being carried out.

.3 Remove stakes and guys at the end of the maintenance period.

3.4 FERTILIZING

.1 Fertilize plant material as necessary to maintain plants in a healthy vigorous growing condition.

3.5 WATERING

.1 Water all plant material every 3 weeks for the period between mid May and mid August, five (5) times per season for the first two growing seasons for a total of ten (10) waterings.

.2 Provide additional watering if required to keep plants well watered to ensure vigorous, healthy growth.

.3 Water seeded areas if seeded in the spring (or early summer) regularly during the first 6-8 weeks after planting, to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent incidents of erosion.

3.6 MOWING SEEDED AREAS

.1 Pollinator Seed Mix: First Year - to control annual invasive species mow seeded areas to a height of 15cm prior to annual and biennial weed seed establishment, as directed by the Departmental Representative. Do not allow the weeds to get taller than 30cm before mowing them down. Remove clippings and cut vegetation which will smother grass. If necessary, repeat mowing during first year. (note: this may require several mowing runs per year with up to once per month during the main growing season; with frequency dependent on rainfall, weed density and height).

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section specifies planting requirements for trees, shrubs and ground cover.

1.2 RELATED SECTIONS

.1 Section 32 93 10, Landscape Maintenance

1.3 QUALIFICATIONS OF CONTRACTOR

.1 Experienced, qualified personnel under the direction and supervision of a foreman with at least five (5) years of horticultural and planting experience will carry out planting and related work.

.2 The work of this Section will be carried out while the Parks Canada Departmental Representative is on site and directly supervising the planting operation.

1.4 REFERENCES

.1 Ontario Provincial Standard Specification (OPSS):

.1 OPSS 801, The Protection of Trees.

.2 Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

.3 Canadian Association for Environmental Analytical Laboratories (CAEAL).

.4 Canadian Nursery Trades Association: Canadian Standards for Nursery Stock, Latest Edition.

.5 American Association of Nurserymen (AAN): Z60.1, Nursery Stock.

.6 Hortus Third, Liberty Hyde Bailey, Hortorium.

.7 Agriculture Canada Publication 1507, The Pruning Manual.

1.5 DEFINITIONS

.1 Measurement:

.1 In size grading Balled and Burlapped (B&B) and wire basket (W.B.) trees, caliper takes precedence over height.

.2 Take trunk caliper 150 mm above the ground level (up to and including 100 mm caliper size) and 300 mm above the ground level for larger diameter trees.

.3 Measure size of container-grown stock by height and width of plant.

.4 Measure herbaceous stock by pot size, not top growth.

1.6 SUBMITTALS

.1 Information Submittals:

.1 The Contractor will provide source and availability of plant material specified on the Plant List(s) to Parks Canada Departmental Representative four (4) weeks prior to commencing the Work.

.2 The Contractor will provide a detailed planting schedule for plant material specified on the Plant List(s) to Parks Canada Departmental Representative four (4) weeks prior to commencing the Work.

.3 Product labels/data sheets on manufactured products specified.

.4 Description of required maintenance activities and activity frequency.

.5 Description of watering program context and frequency to maintain required moisture conditions for optimum growth.

.6 Topsoil test results and fertilizer recommendations for planting soil.

.2 Product Samples: Submit two (2) samples of plant bed mulch, trunk protection devices and accessories for tree-staking/guying for approval prior to initiating planting.

.1 Retain approved samples on Site in a readily available location.

.2 Products used will conform to approved samples.

.3 Topsoil Testing: Test on-site topsoil within thirty (30) working days of planting schedule. Topsoil testing will be the responsibility of the Contractor and will involve the following:

.1 Arrange for and be responsible for costs related to soil testing at a certified soil testing laboratory. Testing laboratory means a facility accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL)/Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), to complete the tests as required by the submission requirements;

.2 Submit two (2) copies of soil analysis and recommendations to Parks Canada Departmental Representative prior to importing or amending planting soil;

.3 Test for N (nitrogen), P (phosphorus), K (potassium), Mg (magnesium), soluble salt content, organic matter, soil sterilants, hydraulic conductivity, particle size distribution and pH;

.4 Laboratory will also provide a fertilizer recommendation that outlines the required improvements to produce an optimum growing environment for the establishment of “young nursery stock”;

.5 Submit laboratory soil analysis and soil amendment recommendations to Parks Canada Departmental Representative for review before acting on the recommendations;

.6 Conform to soil amendment recommendations of the laboratory as approved by Parks Canada Departmental Representative; and

.7 The Contractor will adjust specified fertilizer recommendations and rates, as well as addition of other additives and re-test the planting soil as required by Parks Canada Departmental Representative at no additional cost to Parks Canada Departmental Representative.

.4 Planting Soil Mixture Testing: Utilize approved topsoil and amend as required to produce planting soil mixture. Carry out planting soil analysis as defined above and provide fertilizer recommendations for “young nursery stock”.

1.7 DELIVERY, STORAGE AND HANDLING

.1 The Contractor will arrange for inspection of plant material outlined in the Plant List(s) at its source with the consultant. Acceptance of the plant material at its source does not prevent rejection of the plant material upon delivery to the site or during the planting operation.

.2 Delivery of plant material will be coordinated with planting operations in order to ensure minimum time lapse between digging and replanting of the plant material.

.3 All plant material supplied and planted under this Contract will be protected from damage in accordance with OPSS 801, during construction operations. Plant material damaged by the Contractor’s operations will be replaced at Contractor’s own expense.

.4 All plant material will be inspected upon delivery to the site prior to unloading. A copy of the delivery receipt will be provided at the time of delivery. Off spec material will be removed from site immediately and replacements shipped to the site within two (2) Working Days.

.5 Plant material will be inspected again prior to planting. Off spec material will be removed from the site immediately and replacements shipped to the site within two (2) Working Days.

.6 Plant Material:

.1 Plants will be contained as specified in the Plant List(s) and meet the minimum height and caliper dimension requirements.

.2 Plants will carry a tag from the nursery identifying the nursery, botanical description, container size and plant height/spread/caliper.

.3 Transport plants specified as Balled & Burlapped/Wire Basket with solid root balls wrapped with 150 gram Hessian burlap. Securely bind burlapped rootballs with twine, natural fibre cord, or wire for shipment and handling. Drum-lace balls with a diameter of 800 mm or more.

.4 Transport plants with frozen ball only when they are complete with root system intact.

.5 Transport plants with branches tied in order to prevent damage and pad trunks to avoid abrasion from equipment during transport. Avoid binding of plant material with rope or wire that would damage bark, break branches or destroy the natural shape of the plant.

.6 Transport plants in enclosed vehicles or covered by tarps. Do not permit plants that will be desiccated by wind. Plants arriving on site in unprotected transport will not be accepted.

.7 Prevent drying out of roots, root balls, trunks, branches and leaves of plants from the time of removal at place of origin until they are planted.

.8 All deciduous trees that have budded out and coniferous trees will be thoroughly sprayed with an anti-desiccant immediately before transport to the site. Apply a sufficient amount over trunks, branches and foliage. Plants may be re-sprayed after delivery to the site and once planted if deemed necessary by Parks Canada Departmental Representative.

.9 Balled and burlapped, wire basket and container grown plant material will not be stored on the site unless the rootball or container is protected from the sun and wind and kept moist.

.10 While temporarily stored at the site, plant material will be placed in the shade where possible and soil, dampened straw or similar material will be placed around the root ball and keep moist at times.

.11 Plants with broken or abraded trunks or branches, or with broken cracked root balls, or plants that are desiccated, will be rejected upon arrival at the site.

.12 Plant material deemed unacceptable will immediately be removed from the site by the Contractor.

.7 Deliver planting materials in standard containers. Containers will be marked identifying contents of container, weight, analysis and name of manufacturer.

.8 Store and protect fertilizer, bonemeal, limestone, mulch and similar products to prevent damage from moisture.

1.8 WARRANTY

.1 The warranty will provide for removal and replacement with new plants those transplanted or newly planted plants found defective or will be dead or not in a vigorous, thriving condition during a period of one (1) year after the date of Substantial Performance of the Work. The Contractor's duties and obligations for correction or removal and replacement of defective work will be in accordance with the requirements specified in the General Conditions.

.2 Replace defective plants with new plants free of dead or dying branches and branch tips and bearing foliage of a normal density, size and colour. Closely match new plants to adjacent specimens of the same species and meet the requirements of this Specification.

.3 Plant replacement plants, for those plants that die during a season unfavorable for planting, during the first month of the next favorable planting season.

.4 Plants damaged or lost due to vandalism, or acts of neglect by others are not subject to this warranty, but during the period of one (1) year after the Date of Substantial Performance of the Work, the cost to replace defective plants is set as the initial market price.

.5 The warranty period for replacement plants will be the same as the warranty period applied to the original plants and will extend from the date of acceptance of the replacement.

.6 Final inspection of plant material will be carried out by Parks Canada Departmental Representative at the end of the warranty period. At this time, plants will be in healthy, vigorous growing condition.

1.9 MAINTENANCE

.1 Commence to maintain plant material immediately after planting and maintain plant material in a vigorous growing condition throughout the warranty period.

.2 Maintenance Period: Begin maintenance immediately after planting and continue for a period after the date of Substantial Performance of the Work per the Subcontract Conditions.

.3 In accordance with the accepted submittal on the care and maintenance of plants and as follows:

.1 Maintain by watering, pruning, cultivating and weeding as required for healthy growth. Restore planting saucers;

.2 Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required;

.3 Install and maintain integrity of rodent protection measures (tree guards);

.4 Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease;

.5 Remove guys, stakes and other supports at the end of maintenance period;

.6 Maintenance includes temporary protection fences, barriers and signs as required for protection;

.7 Coordinate watering to provide deep root watering to newly installed trees; and

.8 Install winter protection (burlap) to coniferous trees and remove the following spring during the maintenance period.

1.10 SCHEDULING AND SEQUENCING

.1 The Contractor will provide to Parks Canada Departmental Representative a detailed schedule outlining the proposed planting sequence.

.2 Plant Deliveries: Give written notice to Parks Canada Departmental Representative at least five (5) working days in advance of each delivery date.

.3 Planting Season: Conduct planting during times of the year that are normal for such work as determined by accepted local practice.

.1 Installation of B&B/W.B. and container grown plant material will be carried out from the time the ground is frost free to October 15.

.4 Plant trees and shrubs after the installation of hard structures and surfaces and upon the establishment of final grades. Planting work will be completed prior to initiating seeding work. Plant materials will be installed within a period of time that will allow for seeding of lawns and grasses during an acceptable time of year.

.5 The location of plant material will be staked out on the ground for review by Parks Canada Departmental Representative and the consultant. Excavation will commence following Parks Canada Departmental Representative and consultant inspection and approval of staking.

1.11 ENVIRONMENTAL REQUIREMENTS

.1 Execute work of this Section under suitable weather conditions and in a suitable growth season for each specified material and as approved by Parks Canada Departmental Representative.

2 Products

2.1 PLANT MATERIAL

.1 All plant material will be nursery grown and meet the specifications as set out in the latest Guide Specifications for Nursery Stock prepared by the Canadian Nursery Trades Association (CNTA) for size, height, spread, grading quality and method of cultivation.

.2 All plant material will be supplied from nurseries situated no more than one (1) hardiness zone difference from the site's hardiness zone.

.3 Nomenclature (Names of Plants): In accordance with "Hortus Third" and conforming to the International Code of Nomenclature of Cultivated Plants and the latest edition of Standardized Plant Names.

.4 Plants: No.1 grade, nursery-grown in fertile soil, with ample spacing, regular cultivation, weed and pest control, required moisture and pruning.

.5 Balled and burlapped, wire basket and container grown plant material will be dug and potted in accordance with the latest edition of the Guide Specification for Nursery Stock, prepared by the Canadian Nursery Trades Association/Landscape Canada.

.6 Plant List(s): Plant lists are outlined on Contract Drawings.

.7 Provide the quantity, size, genus, species and variety of trees, shrubs, ground covers and seedlings indicated on the contract drawings.

.8 Quality and Size:

.1 Nursery-grown, habit of growth normal for species, sound, healthy, vigorous, free from insects and injuries, well-branched and densely foliated when in leaf.

.2 Plant material will not be collected or dug from native stands or an established woodlot.

.3 Plants will be free of disease and insect pests, eggs or larvae.

.4 Tree and shrub plants will possess characteristics of the specified kind, with leaders intact, undamaged and uncut, growing from an unmutilated root system. Stems will be free from sun scalds, frost cracks, rodent damage, abrasions, fire and crust. Old injuries will be completely callused over. Pruning wounds will show vigorous bark on edges and parts show live green cambium tissue when cut.

.5 Plant material sizes will be acceptable up to 40% above the measurements specified in the Plant List(s). Measure plants before pruning with branches in their normal position.

.6 Plant material will not be cut back from larger sizes in order to meet the specified Plant List(s) requirements.

.7 Balled and Burlapped Plants: Firm, intact ball of earth encompassing enough of the fibrous and feeding root system to enable full plant recovery.

.1 Burlap, rope and tie material will be manufactured from natural organic fibers.

.8 Wire Basket Plants: Plants dug mechanically, intact soil ball of earth placed in a burlap lined wire basket, cross-laced wire basket, situate trunk in centre of basket.

.9 Container-Grown Plants: Self-established root systems, sufficient to hold earth together after removal from container, without being root bound.

.1 Stock: Grown in delivery containers for at least six (6) months but not over two (2) years.

.2 Well developed and well distributed root system throughout the container, such that the roots visibly extend to the inside face of the growing container.

.9 Label each tree, shrub, ground cover and seedling specimen with a securely attached waterproof tag bearing a legible designation of botanical and common name.

.10 Replacement trees, shrubs, ground covers and other plant material: Same species, size and quality as specified for the plant being replaced.

.11 Substitutions: Substitutions to the plant list(s) will not be permitted unless prior written approval for a substitution from Parks Canada Departmental Representative has been obtained. Plant substitutions will be of a similar species and of equal or greater size than those originally specified. No additional cost will be entertained for substituted plant material.

2.2 TOPSOIL

.1 On-site topsoil from topsoil stripping operations will be used for tree pits and continuous soil corridors for trees.

.2 Topsoil stripped from cleared and grubbed forest floor will be used in the planting area.

.3 Topsoil will be capable of sustaining vigorous plant growth and be free of the following:

.1 Admixture of subsoil, lumps and stones greater than 10 mm in diameter;

.2 Coarse vegetative material greater than 10 mm in diameter and 100 mm in length;

.3 Weeds, weed seeds and rhizomes; and

.4 Toxic material and soil sterilants that will inhibit plant development.

2.3 PLANTING SOIL MIX

.1 Planting Soil Mixture for trees, shrubs, shrub beds and large multi-stem trees.

.1 Premixed 80% sandy loam topsoil and 20% compost and well-rotted sheep's or cow manure.

.2 Do not mix when topsoil is in a muddy or frozen condition.

2.4 ANTI-DESICCANT

.1 Anti-desiccant emulsion will be a product specifically manufactured to provide a flexible surface film to reduce transpiration yet not impede passage of carbon dioxide and oxygen. Anti-desiccants are will be one (1) of the following:

.1 Folicote, a wax emulsion as supplied by J.VIK. Supplies, 1894 7th Street, P.O. Box 910, St. Catharines, Ontario L2R 6Z4, telephone (416) 641-5599;

.2 Siliconate 51T, a silicon as supplied by Rhone – Poulenc Canada Inc., 2000 Argentia Plaza 111, Suite 400, Mississauga, Ontario, L5N 1V9, telephone (416) 821-4450;

.3 Jocryl 1938, an acrylic polymer as supplied by S.C. Johnson and Sons, 17 Still Water Cresent, Brampton, Ontario, L6X 3K6, telephone (416) 453-4505; or

.4 Approved equivalent.

.2 Emulsion to form a permeable film over plant surfaces and mixed according to the manufacturer's instruction.

.3 Transpiration retarding material will be used where plant material is moved during the growing season.

2.5 GUYING AND STAKING

.1 For deciduous and coniferous trees:

.1 Steel T-bar: 50 mm by 50 mm by 5 mm by 1.8 metres. T-bars will be new with a 6 mm hole drilled 150 mm from the top to accommodate a tie wire.

.2 Tree Ties: No. four (4) chain lock tree ties as manufactured by Green Brothers, Ltd or approved equivalent.

.3 Guy Wires and Tree Tie Wire: Wire for tying and guying trees will be galvanized, 12 gauge, ductile steel.

.4 Hose: New or used two (2) ply, reinforced rubber garden hose, not less than 13 mm diameter.

.5 Guy Wire Turnbuckle: Zinc-coated, with 162mm lengthwise opening and at each end 13 mm diameter threaded openings fitted with screw eyes. Turnbuckle will be “Spannix” as manufactured by C. Fensch Limited, P.O. Box 67, Grimsby, Ontario, telephone (416) 945-3817 or approved equivalent.

2.6 TRUNK PROTECTION

.1 Plastic: 100 mm dia. white corrugated PVC pipe 550 mm high. Protect against rodent damage.

.2 Plastic Rodent Guards: 600 mm high, to be used on whips.

2.7 BONEMEAL

.1 Bonemeal: Raw bonemeal, commercial brand, finely ground, with minimum analysis of 2% and 11% phosphoric acid.

2.8 LIME

.1 Lime (used where pH of topsoil is less than 6.0): Limestone containing minimum 85% of calcium and magnesium carbonates combined, finely ground to pass number 10 mesh sieve, with minimum one-half (1/2) passing number 100 mesh sieve.

.2 Rate of application will be determined according to pH of topsoil.

2.9 MANURE

.1 Well-rotted, unleached sheep or cattle manure; free from harmful chemicals and other injurious substances and sawdust, shavings or similar refuse; at least eight (8) months old, but no more than two (2) years old and with no more than 25% straw, leaves or other acceptable materials for planting use.

2.10 COMPOST

.1 Decomposing organic matter such as cow manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.2 Processed organic matter containing 40% (by dry weight) or more organic matter as determined by Walkley-Black or Loss on Ignition (LOI) test.

.3 Product will be sufficiently decomposed (i.e. stable) so that further decomposition does not adversely affect plant growth (C:N ratio below25) and contain no toxic or growth inhibiting contaminates.

.4 Composted bio-solids: To CCME Guidelines for Compost Quality, Category A.

2.11 FERTILIZER

.1 Fertilizers: Commercial, complete, of neutral character; in granular, packet, or pellet form, 75% of nitrogen will be slow release form, 50% of the elements of which will be derived from organic sources.

.2 Fertilizer requirements:

.1 Trees: 10-6-4 at 1 kg per 25 mm of tree caliper or as outlined in planting soil analysis fertilizer recommendations.

.2 Planting Beds: 12-6-4 at 1 kg per cubic metre of planting soil or as outlined in planting soil analysis fertilizer recommendations.

.3 Slow-release and natural organic fertilizers will be incorporated into the planting soil. Quick-release fertilizers will be broadcast after planting and then watered in. Do not mix quick-release forms with the planting soil used to backfill the planting pit.

.4 Incorporate fertilizer into the planting soil mixture in quantities sufficient to overcome chemical deficiencies of soil identified by planting soil analysis report.

2.12 PLANTING BED, TREE AND SHRUB SAUCER MULCH

.1 Shredded pine bark mulch by Gro-Bark-derived from pine, shredded, free from twigs, leaves, branches, noxious weed seed and foreign material harmful to plant growth and other extraneous material. Mulch with artificial dyes will be rejected.

.2 The Contractor will provide a sample of the above or approved equivalent mulch sources for review and approval by Parks Canada Departmental Representative prior to delivery of mulch to the site.

.3 The Contractor will be responsible for pick-up and delivery of approved mulch from source of supply to the site.

2.13 ROOT STIMULANT

.1 “Wurzil” root stimulant dip by The Professional Gardener Co. Ltd., 915-23rd Avenue S.E., Calgary, Alberta, T2G 1P1, telephone (403) 263-4200 or approved equivalent.

2.14 WATER

.1 Water will be potable and free of impurities and chlorine that would inhibit germination and growth.

.2 Water temperature will not be more than 10°C below the ambient air temperature.

.3 The Contractor may obtain water from the City of Waterloo or City of Kitchener, but will make their own arrangements.

.4 Water tanks used for the application of water will be clean and free of contaminants that will be hazardous to the growth and development of plant material or to the general environment.

.5 Pumps used for watering plant material will be capable of reaching the limits of the site. The outlet end of the hose will be 25 mm in diameter with a quick shut-off valve connected to a functioning water injection pipe. The outlet end of the hose must be vandal-resistant or equipped with “anti-vandal” system.

2.15 WOODEN SURVEY STAKE/TREE/SHRUB LAYOUT

.1 Wood stake measuring 600 mm in length. Colour flagging tape will be used to differentiate between stake markers.

3 Execution

3.1 EXAMINATION

.1 Planting work will be carried out to conform to the best horticultural practices.

.2 Ensure that grading and backfilling has been completed in accordance with the Contract Drawings.

.3 Examine the site before commencing the Work and inform Parks Canada Departmental Representative if site conditions will not permit the completion of work of this Section as specified.

.4 Keep the site well drained. Keep landscape excavations dry.

.5 Do not plant material until it has been accepted by Parks Canada Departmental Representative.

.6 Do not remove labels from plants until they have been inspected and accepted after planting by Parks Canada Departmental Representative.

.7 Clean up immediately soil or debris spilled onto pavement and dispose of deleterious materials off-site, at no additional cost to Parks Canada Departmental Representative.

.8 Ensure that barrier fencing is in place to protect existing vegetation being retained prior to commencing cultivation of planting areas.

3.2 LOCATION OF PLANTS

.1 Stake the position of plant material and planting beds as shown on the Planting Plan unless obstructions are encountered, in which case notify Parks Canada Departmental Representative. The location of trees and planting beds, where indicated, are approximate and may require adjustments in the field due to site conditions. The staked location of plant material will be review by Parks Canada Departmental Representative. Excavation will commence following Parks Canada Departmental Representative inspection and approval of staking.

.2 Trees and Shrubs: The location of trees and shrubs has been defined on the Contract Drawings. Refer to the Tree, Shrub and Ground Cover Plant List for quantities designated by Planting Area. The location of plants and shrubs must not hide the view of the LRT's drivers or CCTV cameras.

.1 All shrubs will be situated within a common planting bed unless otherwise noted or illustrated.

.3 Request Parks Canada Departmental Representative to observe and approve of new planting locations, topsoil placement and grading. Adjust as necessary before planting begins.

3.3 PREPARATION

.1 Planting Soil: Delay mixing of fertilizer into planting soil if planting will not follow the preparation of planting soil within three (3) days.

.2 Excavation for Planting:

.3 Excavate for oversized tree pits and continuous soil corridors to the extents shown on the Planting Plan.

.1 Excavate for the shrub beds to the limits shown on the Planting Plan to a depth of 450 mm.

.4 Dispose of unsuitable and excess excavated material from tree pits and planting beds at no additional cost to Parks Canada Departmental Representative.

.5 Salvaged topsoil from woodlot floor will be placed in the woodland tree planting area, the shrub planting area and the seeded open space area, to a depth of 150 mm and graded to produce an irregular surface.

3.4 PLANTING

.1 Plant material will not be placed in the planting pit until evidence of frost has left the ground.

.2 Set plants plumb so that they are in the same relationship to finished grade, after settlement, as they were in the nursery or pot.

.3 Face plants to give best appearance when viewed from prime vantage points and prominent views (sidewalk, building, street) to the acceptance of Parks Canada Departmental Representative.

.4 Do planting in a continuous operation, completing total areas including mulching rather than focusing on completing individual species.

.5 Plant trees before planting surrounding smaller shrubs and seeding.

.6 B&B Plants: Place in pit by lifting and carrying by its ball (do not lift by branches or trunk). Lower into pit and place rootball on compacted ground. Set straight in pit center with tip of rootball 75 mm above the adjacent finish grade.

3.5 BACKFILLING

.1 Backfill with planting soil in maximum 150 mm lifts and tamp placed planting soil to remove air pockets between lifts. Take care not to injure root system. When excavation is two-thirds (2/3) full, water thoroughly before placing remainder of backfill in order to eliminate air pockets. When the planting pit has been backfilled to finished grade, the final backfill layer will be used to form an earthen berm/saucer around the outside perimeter of the planting pit. The berm/saucer will be a maximum of 100 mm high and a maximum of 150 mm wide. The berm/saucer will be formed

using the excavated soil material. If the pit is on a slope, the lower edge and sides will be built up to contain and hold water. Water immediately after completion of backfilling.

.2 Balled and Burlapped (B&B)/Wire Basket (W.B.) Plants:

.1 Remove synthetic material prior to backfilling.

.2 Partially backfill pit to support plant.

.3 Backfill in maximum 150 mm lifts and compact to remove air pockets until planting pit is one-third (1/3) full.

.4 Remove burlap and binding from sides and top one third of root ball. Do not pull burlap from under rootballs. Remove upper one-third (1/3) of wire basket from entire circumference from W.B. plants.

.5 When excavation is approximately two-thirds (2/3) full, water thoroughly before placing remainder of backfill to eliminate air pockets. Complete backfilling in 150 mm lifts until finished grade is achieved.

.6 Never cover the top of the rootball with soil.

.7 Establish tree saucer and water as outlined above.

.8 Provide an earth saucer at the base of individual trees and shrubs. Diameter of saucer to correspond to planting pit diameter as outlined on planting detail drawings.

3.6 GUYING AND STAKING

.1 All trees will be staked and tied immediately following planting to ensure vertical alignment and plant stability in accordance with Contract Drawings.

.2 Staking: Support deciduous trees 40 mm in caliper and less with one (1) stake. For deciduous trees with a caliper greater than 40 mm use two (2) stakes spaced equally about each tree in line with the tree trunk. Support coniferous trees up to 1.5 metres in height with two (2) stakes spaced equally about each tree in line with tree trunk. Support conifers greater than 1.5 metres in height with three (3) stakes spaced equally about each tree.

.3 Guying: Support coniferous trees greater than 1.5 m with one (1) guy wire for each stake.

.4 Rubber hose will be used as a cover over tie to protect the tree bark from damage. The rubber hose will be cut to a sufficient length to encircle the tree trunk loosely and provide the necessary support.

.5 Bright red plastic surveyor’s tape will be tied to guy wires. The tape will be tied halfway up the length of the wire and will be clearly visible. Guy wires will be tightened using galvanized turnbuckles.

.6 Adjust tension in guy wires and ties as required during the warranty period.

.7 Remove stakes and guy wires at the end of the warranty period.

3.7 FERTILIZER

.1 Add as top dressing depending on plant size and manufacturer’s recommendations upon completion of planting operation or during the guarantee period.

3.8 MULCH INSTALLATION

.1 Immediately after planting, prior to the initial watering and seeding, install mulch within two (2) days after installation of plant material.

.2 Mulch will be applied in a uniform continuous blanket to the surface area surrounding each individual tree and shrub. Depth of mulch will be 75 mm (after settlement). Excess mulch will be turned over to Parks Canada for future adjustments.

.3 For trees, the mulch surface area will extend over the full extent of the planting pit and the earth berm/saucer and include an additional 300 mm radius beyond the circumference of the earth berm/saucer.

.4 Keep mulch 150 mm to 250 mm away from the trunk of plant material to prevent rodent nesting and disease (rot).

.5 Saturate the planting area with water after placing mulch.

3.9 WATERING

.1 Watering of plant material will commence immediately following installation. Apply sufficient water to saturate the root zone.

.2 Initial watering will be uniformly applied to each individual tree by two injection applications directly into the soil. Both injections will be located at the outer edge of the planting pit and will penetrate the ground to a depth of 450 mm. The second injection will be 180° from the initial injection.

.3 Water will be uniformly applied to avoid dislocating mulch, soil and plant material.

.4 Do not overwater or drown plants.

.5 Keep plants well watered to ensure a vigorous, healthy growing condition during establishment period.

.6 The Contractor will maintain appropriate hydrological conditions using available water or imported potable water as required maintaining plant material in a vigorous, healthy growing condition.

3.10 PRUNING AND REPAIR

.1 All pruning will be carried out in accordance with Agriculture Canada Publication 1507-1977 “The Pruning Manual”.

.2 Prune only after planting and in accordance with standard horticultural practice to preserve the natural character of the plant. Perform in the presence of Parks Canada Departmental Representative.

.3 Remove dead wood, suckers and broken or injured branches.

.4 Do not remove leaders. Do not plant trees without a prominent, vigorous leader.

.5 Use sharp, clean tools. Make cuts smooth, clean and flush to base members. Leave no stubs.

.6 Cut back cambium to living tissue where cuts are made and at bruises, scars and other injuries. Shape wood to prevent the retention of water.

3.11 WEED CONTROL

.1 Maintain a weed-free condition within planting areas.

3.12 PROTECTION OF INSTALLED WORK

.1 Protect planting areas and plants against damage for the duration of the maintenance period.

3.13 ADJUSTMENT AND REPLACEMENT

.1 Perform adjustment and replacement work with materials of the same type and quality as outlined in the Plant List(s) on Contract Drawings. Replacement work will have a guaranty of the same length with the same conditions as outlined in this Specification. Date of renewed guarantee will be from the time of approval of replacement work. The Contractor will document replacement materials on the Record Drawings identifying the plant material location, plant species name, quantity, reason for replacement and date of replacement. A copy of replacement work carried out will be provided to Parks Canada Departmental Representative within fifteen (15) working days of Substantial Performance of the Work.

3.14 WATERING DURING THE MAINTENANCE PERIOD

.1 Refer to Section 32 93 10 Landscape Maintenance for extra watering required during the warranty period.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

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

1.2 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C110/A21.10-08, American National Standard for Ductile-Iron and Gray Iron Fittings for Water.

.2 ANSI/AWWA C153/A21.53-11, Standard for Ductile-Iron Compact Fittings.

.3 ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.

.4 ANSI/AWWA C504-10, Standard for Rubber-Seated Butterfly Valves.

.5 ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.

.6 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.

.7 ASTM B88M-05(2011], Standard Specification for Seamless Copper Water Tube [Metric].

.2 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS.MUNI 401 – Construction Specification for Trenching Backfilling and Compacting.

.2 OPSS.MUNI 403 – Construction Specification for Rock Excavation for Pipelines, Utilities and Associated Structures in Open Cut.

.3 OPSS.MUNI 441 – Construction Specification for Watermain Installation in Open Cut.

.4 OPSS.MUNI 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

.3 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 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.

.4 CSA International

.1 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.1 CAN/CSA-B137.1-[09], Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.2 CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.3 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.

.4 Pipe certification to be on pipe.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

1.5 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Do not interrupt water service for more than 3 hours.

.3 Notify fire department of planned or accidental interruption of water supply to hydrants.

.4 Provide and post "Out of Service" sign on hydrant not in use.

2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 Polyethylene pressure pipe:

.1 NPS 1/2 to NPS 6: to CAN/CSA-B137.1 type PE 3406. ASTM F714, type PE 3408.

.2 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657.

.3 Polyethylene fittings: to CAN/CSA-B137.1, for pipe sizes NPS 4 and less.

2.2 PIPE PROTECTION

.1 Provide means of protection for iron pipe in corrosive soils in accordance with local practices and authorities having jurisdiction.

2.3 VALVES AND VALVE BOXES

.1 Valves to open clockwise.

.2 Gate valves: to ANSI/AWWA C500, standard iron body, brass mounted wedge valves with non-rising stems, suitable for 1 Pa with flanged joints.

.3 Cast iron valve boxes: three piece sliding type adjustable over minimum of 450 mm complete with valve operating extension rod, 25 x 25, 150 mm below cover.

.1 Base to be large round type with minimum diameter of 300 mm.

.2 Top of box to be marked "WATER"/"EAU".

2.4 SERVICE CONNECTIONS

.1 Copper tubing: to ASTM B88M type K, annealed.

.2 Polyethylene pressure pipe:

.1 To CAN/CSA-B137.1, type PE, series 160.

.3 Copper tubing joints: compression type suitable for 1 MPa working pressure.

.4 Polyethylene pipe joints: plastic insert type serrated sleeves with four stainless steel screws and band-type clamps per joint.

.5 Brass Corporation stops: red brass to ASTM B62, compression type having threads to ANSI/AWWA C800.

.6 Brass inverted key-type curb stops: red brass to ASTM B62, compression type without drains.

.1 Curb stops to have adjustable cast iron service box with stem to suit depth of bury.

.2 Top of cast iron box marked "WATER"/"EAU".

.7 Polyethylene tapping tees or multi-saddle tees: for Polyethylene pipe. Tees to be socket fused to pipe.

2.5 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to: OPSS.MUNI 1010.

.1 Crushed or screened stone, gravel or sand.

2.6 BACKFILL MATERIAL

.1 Native material as approved by Parks Canada Departmental Representative and Consultant or Granular ‘B’ Type 2 as per OPSS.MUNI 1010.

2.7 PIPE DISINFECTION

.1 Sodium hypochlorite to ANSI/AWWA B300.

.2 Disinfect water mains in accordance with ANSI/AWWA C651 and in accordance with local requirements.

2.8 POTABLE WATER CISTERN

.1 30,000 litre (nominal capacity) precast concrete potable water cistern with side wall knockouts to accommodate 100 mm diameter pipe sleeve.

.2 Concrete 35 Mpa at 28 days, 5-7% air entrainment.

.3 Pipe penetrations to be sealed with Link-Seal modular seals or approved equal.

.4 Provide Cast in access riser with a 500 x 500 mm clear opening stainless steel lockable access hatch.

.5 Provide non-toxic primer and mastic band joint sealant for a solid watertight seal to be applied to the external surface of the tank over the joint between sections by the installing contractor.

.6 Provide Polyethylene coated aluminum ladder rungs to the floor.

.7 Provide top section lifting points at four places and bottom section lifting points at four places.

.8 Provide Clean out sumps at four places.

.9 Provide Stainless Steel Cross Beams.

.10 Submit complete shop drawings for precast concrete cistern showing all reinforcing, pipe connections, and all ancillary components. Submit shop drawings for Link-Seal.

.11 Connections, refer to drawings:

.1 100mm (4”) diameter 316 stainless steel vent pipe.

.2 38mm (1 1/2”) diameter main fill pipe on top of the cistern.

.3 100mm (4”) diameter auxiliary fill pipe on top of the cistern.

.4 19mm (3/4”) diameter chlorinated return pipe on side of the cistern.

.5 100mm (4”) diameter outlet pipe on bottom level of the cistern, complete with Stainless Steel foot valve assembly.

2.9 PRECAST CONCRETE WET WELL FOR POTABLE WATER

.1 1200 mm x 1200 mm (internal dimensions) x 2616 mm ht. precast concrete manhole with chamber capacity 1440 litres per vertical metre.

.2 35 Mpa at 28 days, 5-7% air entrained. Precast concrete materials and construction conforms with CSA A23.4-00.

.3 Reinforcing shall consist of 10 M bars at 150 mm centres each way in roof, walls and floor. Extra 15 M bars around the roof access opening. Min cover over reinforcing steel-25 mm.

.4 316 stainless steel vent pipe.

.5 Drip proof and lockable frame and cover. Cast Into Top Slab Standard Construction Is 5 mm. stainless steel.

2.10 POTABLE WATER WET WELL SUBMERSIBLE PUMP

.1 Furnish and install, as shown on the plans, Grundfos submersible pump, Model 4” (100mm) 77S30-6. The pump shall be Multi-stage submersible pump for raw water supply and pressure boosting. The pump shall be suitable for pumping clean, thin, non-aggressive liquids without solid particles or fibers.

.2 Specifications:

.1 Six impellers, complete with stainless steel shaft and impeller and mechanical seal

.2 Capacity: 284 L/m (75 gpm)

.3 Head: 34m (110 ft)

.4 Discharge size: 50mm (2”)

.5 Motor Horsepower: 3 Hp

.3 The pump shall be made entirely of Stainless steel and suitable for vertical installation. The pump shall be fitted with a built-in check valve.

.4 The motor shall be 240V/1ph/60Hz and be UL listed and CSA approved. Motor shall be of the canned type with a sand shield, liquid-lubricated bearings and pressure-equalizing diaphragm.

.5 Provide MS4000 motor and motor control box for the pump, suitable for outdoor installation.

.6 Acceptable alternates subject to shop drawing review:

.1 Sulzer

.2 Goulds

.3 S. A. Armstrong

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Parks Canada Representative and Consultant.

.2 Inform Parks Canada Representative and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Parks Canada Representative and Consultant.

3.2 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.2 Inspect materials for defects to approval of Parks Canada Representative and Consultant.

.3 Remove defective materials from site as directed by Parks Canada Representative and Consultant.

3.3 POTABLE WATER CISTERN

.1 Install cistern in accordance with manufacturer’s instructions.

.2 Install water cistern to elevations and layout coordinates indicated on the layout and grading plans, details and per the precast concrete fabricator installation guidelines.

3.4 PRECAST CONCRETE WET WELL

.1 Install precast concrete wet well to elevations and layout coordinates indicated on the layout and grading plans, details and per the precast concrete fabricator installation guidelines.

.2 Bottom line of the precast concrete wet well shall be level with the bottom line of the cistern.

3.5 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Trench alignment and depth require Parks Canada Representative's and Consultant's approval prior to placing bedding material and pipe.

3.6 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness [to depth of 150 mm below bottom of pipe.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to 95 % minimum of maximum dry density to ASTM D698.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling with compacted bedding material.

3.7 PIPE INSTALLATION

.1 Terminate building water service from the well inside the mechanical room as noted on the mechanical drawings.

.2 Lay pipes in accordance with OPSS.MUNI 441.

.1 Do not use blocks except as specified.

.3 Join pipes in accordance with OPSS.MUNI 441.

.4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 Lay pipes on prepared bed, true to line and grade.

.6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.8 Do not lay pipe on frozen bedding.

.9 Do hydrostatic and leakage test and have results approved by Parks Canada Departmental Representative and Consultant.

.10 Backfill remainder of trench.

3.8 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

3.9 SERVICE CONNECTIONS

.1 Terminate building water service from water well inside the mechanical room as shown on the mechanical drawings.

.1 Install coupling necessary for connection to building plumbing.

.2 If plumbing is already installed, make connection.

.2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.

.3 Construct service connections at right angles to water main unless otherwise directed.

.4 Tappings for PE pipe: PE tapping tees or multi-saddle tees.

.5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.6 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.

.7 Leave corporation stop valves fully open.

.8 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.9 Install curb stop with corporation box on services NPS 2 or less in diameter.

.1 Set box plumb over stop and adjust top flush with final grade elevation.

.2 Leave curb stop valves fully closed.

.10 Place temporary location marker at ends of plugged or capped unconnected water lines.

.1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.

.2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.10 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C600 and OPSS.MUNI 44.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify Parks Canada Departmental Representative and Consultant at least 24 hours in advance of proposed tests.

.4 Perform tests in presence of Parks Canada Departmental Representative and Consultant.

.5 Undertake any repairs and repeat all testing at no additional cost until satisfactory results are achieved.

3.11 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Compact backfill to at least 95% maximum density to ASTM D698.

3.12 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations: witnessed by Parks Canada Departmental Representative and Consultant.

.1 Notify Parks Canada Department Representative and Consultant at least 4 days in advance of proposed date when disinfecting operations will begin.

3.13 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.9 Section 01 78 00 - Closeout Submittals

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

.11 Section 33 11 16 – Site Water Utility Distribution Piping

1.2 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

.1 AWWA A100-06, Standard for Water Wells.

.2 AWWA C654-03, Standard for Disinfection of Wells.

.2 ASTM International

.1 ASTM B124/B124M-11b, Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes.

.2 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM F480-06e1, Standard Specification for Thermoplastic Water Wall Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80.

1.3 DEFINITIONS

.1 Annular space: space between well casing and borehole wall.

.2 Aquifer: part of formation or group of formations that is water bearing.

.3 Available drawdown: difference in elevation between static level and top of screen, or between static level and 2 m above bottom of well in case of wells with no screen.

.4 Consolidated formation: a geologic formation of bedrock.

.5 Development: application of appropriate techniques to bring well to maximum production capacity and control concentration of suspended solids.

.6 Drawdown: difference in elevation, between static level and pumping level.

.7 Perennial yield: maximum rate of flow that could be sustained when pumping well at constant rate for period of 7 log cycles on time/drawdown chart (approximately 19 years).

.8 Potable water: water that is safe for human consumption.

.9 Pumping level: difference in elevation between well datum and water level when well is being pumped at stated L/s rate.

.10 Recovery: time taken for water level to return from pumping level to static level after pumping stops.

.11 Specific capacity: ratio of pumping rate to drawdown, expressed in L/s.m of drawdown.

.12 Static level: difference in elevation between well datum and level of water in well when no pumping has been conducted for at least 6 hours.

.13 Unconsolidated formation: geologic formation of sand, gravel or other soil strata.

.14 Well datum: top of outer casing or similar fixed point of well head with elevation tied to geodetic or suitable local datum.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.2 Submit printed product literature and data sheets for permanent well casing and screen and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for well pump.

.3 On completion of Work, submit report including information as follows:

.1 Log of well drilling.

.2 Geophysical logs.

.3 Record drawing of well including:

.1 Elevations.

.2 Size and length of each casing section installed.

.3 Grouting details.

.4 Description of screen.

.5 Gravel packing details.

.4 Records of static water level measurements, times at which they were taken and any observable changes in static water level with well depth.

.5 Results of final pumping tests.

.6 Well development data.

.7 Results of testing of water sample for chemical and bacteriological content and suspended solids.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Use hydrogeologist, approved by Parks Canada Departmental Representative and Consultant to advise on well construction and materials.

1.7 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect piping and well pump from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 PERMANENT WELL CASING

.1 AWWA C200

.1 Internal diameter: 4.00” (101.60 mm)

.2 Wall thickness: .250” (6.35 mm)

.3 Mass: 11.60 lbs per foot (17.26 kg/m)

.2 Use pipe fittings of same standard as pipe casing.

.3 Joints: threaded couplings.

2.2 SUBMERSIBLE WELL PUMPS

.1 Grundfos 3” (75 mm) 15SQE07-180 submersible pump, or approved equivalent.

.1 Material of construction: Stainless steel 304 shaft and discharge chamber, Polyamide impeller and vanes, Stainless steel 316 sand trap and springs.

.2 Capacity: 42 L/m (11 gpm)

.3 Head: 73 m (240 ft)

.4 Discharge size: 32mm (1 1/4”)

.2 The motor shall be 240V/1ph/60Hz and be UL listed and CSA approved. Motor Horsepower: 3/4 Hp

.3 The pump shall be fitted with a built-in check valve.

.4 Provide power/control box for the pump, suitable for outdoor installation.

2.3 SCREEN

.1 Continuous well screen to following requirements:

.1 Material: stainless steel.

.2 Type: continuous slot.

.3 Openings: to be determined by well driller.

.2 Couplings to connect screen sections, when required, to be of same material as screen.

.3 Provide screen with quick setting concrete plug to close bottom.

.4 Provide screen with neoprene seal at top.

.5 Join screen to casing by coupling.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for water supply well installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Parks Canada Departmental Representative and/or Consultant.

.2 Inform Parks Canada Departmental Representative and/or Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Parks Canada Departmental Representative and/or Consultant.

3.2 DRILLING

.1 Use drilling equipment, methods, fluids and additives approved in writing by Parks Canada Departmental Representative and/or Consultant.

.2 Drill in locations and to depths as directed by Parks Canada Departmental Representative and/or Consultant.

.3 Drill holes plumb and straight.

.4 Dispose of drill cuttings as directed by Parks Canada Departmental Representative and/or Consultant.

.5 Ensure drilling methods do not impair production from aquifers encountered.

.6 Prevent foreign matter from entering bore hole and prevent contaminated water or other objectionable fluids from reaching aquifer through bore hole.

.7 Cover top of bore hole to prevent tampering and eliminate dangerous conditions for persons or animals in area.

.8 Maintain log of bore holes including information as follows:

.1 Depth of changes in formation.

.2 Description of formations encountered.

.3 Elevations at which aquifers are encountered, sudden changes in water level, loss of drilling fluid or other indications of permeable strata.

.9 In unconsolidated formations, obtain duplicate soil samples from each 3m maximum of depth drilled and at least one set of duplicate samples from each formation encountered.

.1 Submit samples to Parks Canada Departmental Representative and/or Consultant with identification data on drill hole and depth.

.10 Obtain continuous samples for 7 m minimum through aquifer.

.1 Screen samples using split spoon sampling or other method approved in writing by Parks Canada Departmental Representative and/or Consultant.

.11 Conduct pumping tests, and obtain clear water samples as directed by Parks Canada Departmental Representative and/or Consultant.

.12 Be prepared to control, shut off hole if flowing artesian water encountered.

.13 Equip arterial wells with variable flow control device to control rate of flow after completion.

.1 Stop flow of water for period of 4 hours minimum by closing control device, and determine if well is effectively sealed to prevent escape of water from annular space of well and immediate vicinity.

.2 Seal off water by grouting as necessary.

.14 Seal abandoned holes by approved methods with concrete, cement bentonite grout, or other material approved in writing by Parks Canada Departmental Representative and/or Consultant.

.15 Redrill holes lost due to caving or abandoned due to loss of drilling equipment.

3.3 SCREEN INSTALLATION

.1 Advise Parks Canada Departmental Representative and/or Consultant of type and size of screen required after aquifer material has been sampled and analyzed.

.2 Install screen in accordance with manufacturer's written recommendations.

3.4 PERMANENT CASING INSTALLATION

.1 Clean casing pipe and fittings prior to installation.

.2 Install permanent well casing to sizes and depths as specified and as directed by Parks Canada Departmental Representative and/or Consultant.

.3 Centre casing by use of centreing brackets spaced 15 m maximum apart and install to ensure variance from vertical does not exceed two thirds internal diameter of casing per 30 m maximum of depth.

.4 Prove alignment by lowering straight section of pipe 12 m long minimum, with outside diameter 12mm maximum smaller than internal diameter of casing being tested, into casing.

.1 If plumb fails to move freely through casing to lowest anticipated pumping level, correct alignment.

.5 Seal annular space between casing and borehole wall by grouting, to prevent entrance of surface water or other deleterious matter into aquifer, and to prevent intermixing of water.

.6 After grouting is completed, cut off casing squarely and neatly, 450 mm maximum above ground level.

.1 Cover casing with flanged cap to approval of Parks Canada Departmental Representative and/or Consultant.

.7 Maintain accurate records of casing lengths and sizes installed.

3.5 GRAVEL PACKING

.1 Ensure gravel used for gravel packing is clean, rounded, water washed quartz or granitic gravel free of silt, clay and other deleterious materials.

.1 Gradation as determined by contractor after analysis of aquifer samples.

.2 Relative density (formally specific gravity): 2.5 minimum.

.3 Thin, flat and elongated particles: 2% maximum by mass.

.2 Place gravel packing as indicated by approved methods acceptable to Parks Canada Departmental Representative and/or Consultant.

.3 Store gravel packing in manner which avoids contamination.

3.6 GROUTING AND SEALING

.1 Seal casing of well extending into consolidated formation into upper 1.5m of formation by grouting with neat cement grout.

.2 Drive steel casing into consolidated formation until seal is obtained. Grout thermoplastic casing into upper 1m of formation.

.3 Fill annular space below 3m depth as indicated.

.4 Grout annular space from ground surface to 3m minimum depth using bentonite.

.5 Use retainer, packer or plug at bottom as necessary to ensure grout does not leak into well.

.6 When further drilling is required after grouting, do not drill until 72 hours minimum after complete placement of grout.

3.7 DISINFECTION

.1 After well has been completely constructed, thoroughly clean of foreign substances, including tools, timbers, rope, cement, oil, grease, joint dope and scum.

.1 Thoroughly swab casing pipe using alkalis if necessary to remove oil, grease or joint dope.

.2 Disinfect well in accordance with AWWA C654.

3.8 TEST PUMPING

.1 Conduct interim test pumping during construction as directed by Parks Canada Representative and/or Consultant.

.2 Develop well, to optimize yield.

.3 Final test pumping as follows:

.1 Pumping rate as directed by Parks Canada Departmental Representative and/or Consultant.

.2 Testing time of as directed by Parks Canada Departmental Representative and/or Consultant.

.3 After pumping begins, record water level in well at intervals as follows: every minute for first 10 minutes, every 2 minutes for next 10 minutes, every 5 minutes for next 40 minutes, every 10 minutes for next 1 hour, every 30 minutes for next 3 hours every hour for next 5 hours and every 2 hours to end of test.

.4 After test pumping has ceased, record water level at same time intervals as before until static water level is reached.

.5 Take temperature of water discharged from well during test pumping at intervals of 1 hour.

.4 When test pumping is to be conducted after disinfection, swab with strong chlorine solution parts of test pump coming into contact with well water prior to start of test pumping.

.5 Should test pump fail during pump test, allow water to reach static level prior to recommencing test.

.6 Do not allow pumping level to fall below elevation 2 m above top of well screen.

3.9 WATER SAMPLING

.1 Obtain 4 minimum water samples from well during test pumping for analysis by Parks Canada Departmental Representative and/or Consultant for suspended solids.

.2 Supply field turbidity metre.

.1 Measure and record water turbidity every 30 minutes during pumping.

.3 During final test pumping, obtain 2 minimum water samples for bacteriological analysis and 1 sample minimum for chemical analysis 1/2 hour after start of test pumping and again during last 15 minutes of test pumping. Total of 6 samples minimum.

.4 Submit samples to Parks Canada Departmental Representative and/or Consultant.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00 - Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort 600 kN-m/m3.

.2 ASTM D2680-01(2009), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

.3 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.4 ASTM D3350-10, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.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 CAN/CGSB-34.9-M94, Pipe, Asbestos Cement, Sewer.

.3 CSA International

.1 CSA B1800-[11], Thermoplastic Non-pressure Pipe Compendium.

.1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.

.2 CSA B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.

.3 CSA B182.6-11, Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications.

.4 CSA B182.11-11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS.MUNI 401 – Construction Specification for Trenching, Backfilling and Compacting

.2 OPSS.MUNI 410 – Construction Specification for Pipe Sewer Installation in Open Cut

.3 OPSS.MUNI 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Parks Canada Representative and Consultant 24 hours minimum in advance of any interruption in service.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

2 Products

2.1 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to CSA B182.2.

.1 Standard Dimensional Ratio (SDR): 35.

.2 Locked-in gasket and integral bell system.

.3 Nominal lengths: 6 m.

.2 Acrylonitrile - Butadiene - Styrene (ABS): to CSA B182.2.

2.2 SERVICE CONNECTIONS

.1 Type PSM Poly (Vinyl) Chloride: to CSA B182.2.

.2 Plastic pipe: to CSA B182.1, with push-on joints.

2.3 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material to OPSS.MUNI 1010.

2.4 BACKFILL MATERIAL

.1 As indicated.

.2 Granular ‘B’ Type 2, in accordance with OPSS.MUNI 1010.

3 Execution

3.1 PREPARATION

.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 sediment and erosion control drawings that complies 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.

.2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Parks Canada Representative and Consultant.

.3 Clean and dry pipes and fittings before installation.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

.2 Protect trench from contents of sewer or sewer connection.

.3 Trench alignment and depth require approval of Parks Canada Representative and Consultant prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.4 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Parks Canada Representative and Consultant.

.2 Handle pipe using methods approved by Parks Canada Representative and Consultant.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Joint deflection permitted within limits recommended by pipe manufacturer.

.6 Water to flow through pipe during construction, only as permitted by Parks Canada Representative and Consultant.

.7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's written recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and foreign material.

.5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 When stoppage of Work occurs, block pipes as directed by Parks Canada Representative and Consultant to prevent creep during down time.

.11 Plug lifting holes with pre-fabricated plugs approved by Parks Canada Representative and Consultant, set in shrinkage compensating grout.

.12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.14 Use prefabricated saddles or field connections approved by Parks Canada Representative and Consultant, for connecting pipes to existing sewer pipes.

.1 Joints to be structurally sound and watertight.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Parks Canada Representative and Consultant has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150mm compacted thickness as indicated.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.

.6 Compact each layer from [mid height]of pipe to underside of backfill to at least 95% maximum density to ASTM D698.

.7 When field test results are acceptable to Parks Canada Representative and Consultant, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150mm compacted thickness up to grades as indicated.

.3 Compact backfill to at least 95% maximum density to ASTM D698.

3.7 SERVICE CONNECTIONS

.1 Install pipe to CSA B182.1, manufacturer's instructions and specifications.

.2 Maintain grade for 100 and 125 mm diameter sewers at 1 vertical to 50 horizontal unless directed otherwise by Parks Canada Representative and Consultant.

.3 Service connections to main sewer: Tee, standard Wye fittings and approved saddles.

.4 Service connection pipe: not to extend into interior of main sewer.

.5 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.

.1 Use long sweep bends where applicable.

.6 Plug service laterals with water tight caps or plugs as approved by Parks Canada Representative and Consultant.

.7 Place location marker at ends of plugged or capped unconnected sewer lines.

.1 Each marker: 38 x 89mm stake extending from pipe end at pipe level to 0.6m above grade.

.2 Paint exposed portion of stake red with designation SAN SWR LINE in black.

3.8 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Parks Canada Representative and Consultant draw tapered wooden plug with diameter of 50mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Do infiltration and exfiltration testing as specified herein and in accordance with OPSS.MUNI 410.

.1 Perform tests in presence of Parks Canada Representative and Consultant.

.2 Notify Parks Canada Representative and Consultant 24 hours minimum in advance of proposed tests.

.6 Television and photographic inspections:

.1 Carry out inspection of installed sewers by video camera, digital camera or by other related means.

.2 Provide means of access to permit Parks Canada Representative and Consultant to do inspections.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

END OF SECTION

1 General

1.1 INTENT OF SECTION

.1 This section covers the technical criteria, supply and installation for a raised filter type leaching bed including clearing and grubbing of the site, rock removal (as required), distribution headers, drainage swales and piping, observation wells and lysimeters as shown on the contract drawings.

1.2 REFERENCE AND STANDARDS

.1 The following references and standards apply:

.1 ASTM C127 – Standard Test Method for Specific Absorption of Coarse Aggregate

.2 ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates

.3 ASTM C702 - Methods for Reducing Field Samples of Aggregate to Testing Size

.4 ASTM D75 - Practice for Sampling Aggregates

1.3 DEFINITIONS

.1 The following definitions apply to this specification:

.1 **Effective Size (ES).** The mesh size opening that will just pass 10 percent (by weight) of a representative sample. ES is measured in millimeters (mm). The effective size is determined by a dry, 10-minute automatic sieve shaker procedure on a 500-800 gram sample with U.S. Sieve Nos. 12, 14, 16, 18, 20, 30, as well as a pan.

.2 **Uniformity Coefficient (UC).** A ratio calculated as the mesh size opening that will just pass 60 percent (by weight) of a representative sample of the filter sand divided by the mesh size opening that will just pass 10 percent (by weight) of the same sample. The uniformity coefficient is determined by a dry, 10-minute automatic sieve shaker procedure on a 500-800 gram sample with U.S. Sieve Nos. 12, 14, 16, 18, 20, 30, as well as a pan.

.3 **Percent Fines.** The percent (by weight) of a representative filter sand sample passing through a U.S. No. 200 mesh.

.4 **Filter Materials.** Specially processed sand and gravel that are used to remove particulate matter from water during filtration.

.5 **New Sand.** Filter sand that is produced from raw materials that have not previously been used for any other purpose.

.6 **"Sub-Round"** grains are essentially round with smooth surfaces (non-angular).

.7 **"Sub-Angular"** grains are essentially sub-angular with multifaceted smooth edges.

.8 **"Fines Content"** is the filter media as particles passing through a U.S. Sieve No. 30.

.9 **"Course Content"** is the filter media as particles retained on a U.S. Sieve No. 12.

1.4 SUBMITTALS

.1 Shop Drawings

.1 Submit the Shop Drawings for review in accordance with Section – Submittal Procedures.

.2 The shop drawing submission shall include, but not be limited to, the following:

.1 Provide sieve test results and corresponding accumulative percent passing in accordance with Part 2.4 and 2.5.

.2 Specific gravity, sieve analysis, uniformity coefficient, and acid test.

.2 Samples and Tests

.1 Before shipment to site, submit for approval, samples of not less than 0.5 Kg of the filter media proposed, and the results of all tests and indicate the source of the media material.

.2 Before shipment to site, collect filter material samples and submit to the Engineer. Retain an independent testing company, which may be chosen by the Supplier, but acceptable to the Engineer to conduct the following tests on each of the samples collected.

.3 Conduct all tests necessary to obtain the information defined in Part 2 of the specification.

.4 All material not meeting these specifications will be rejected.

.5 Retest additional samples if any results are unsatisfactory,

.6 Do not ship the material to the site until approval has been given by the Engineer.

.7 Furnish material equal in all respects to the approved samples.

.3 Mock-up Area

.1 After submission of samples complete with gradation curves for review, construct mock-up area for undertaking onsite testing.

.2 Construct a 3m x 3m mock-up area onsite of leaching bed. Construct in layers as shown on Part 2.1.1.

.3 Perform T tests for layers 4, 5 and 6. If T tests vary by +0% to -10% (e.g. for a T of 6-10 min/cm the T value should not exceed 10 min/cm of be less than 5 min/cm).

.4 If the T values are out of compliance, remove the mock-up test bed and reconstruct the mock-up area and retest until the testing confirms the T value requirements.

.5 All T tests are to be completed under the supervision of a Geotechnical Engineer paid for by the Contractor.

2 Products

2.1 GRAIN SHAPE, EFFECTIVE SIZE (ES), AND UNIFORMITY COEFFICIENT (UC)

.1 The raised filter bed must conform to the conditions.

	Soil Layers/ Distribution	Effective Size	Uniformity Coefficient	Depth mm	T Value min/cm	Other
1.	Top Soil			150		Screened
2.	Filter Fabric					Refer to Section 2.9
3.	Stone Layer	19 mm to 25 mm clear aggregate washed		300		Continuous over the entire surface
4.	Top Sand Layer	0.25-2.5	1.5 to 3.76	600	6-10 min/cm	No organic material. Refer to Section 2.5 Gradation Envelope for Leaching Bed (T = 6-10 min/cm)
5.	Second Layer	0.25-2.5	1.5 to 3.76	600	12-15 min/cm	No organic material. Refer to Section 2.4 Gradation Envelope for Leaching Bed (T<15 min/cm)
6.	Extended Sand Layer	0.25-2.5	1.5 to 3.76	300	12-15 min/cm	Keyed into existing (native) ground

.2 The filter leaching bed media shall predominately be siliceous material that will resist degradation during handling and use.

.3 Crushed gravel is not acceptable.

2.2 SPECIFIC GRAVITY

.1 Dry specific gravity must be greater than 2.5.

2.3 HARDNESS

.1 Minimum 6.0 on Moh's Hardness scale (ref. Testing and Inspection of Engineering Materials; McGraw-Hill Cook Co., New York, NY; 3rd Edition; page 209).

2.4 GRADATION ENVELOPE FOR LEACHING BED (T<15 MIN/CM)

Grain Size (mm)	Lower Limit Percent Passing	Upper Limit Percent Passing
0.01	0	NA
0.05	4	0
0.25	6	1
0.3	10	2
0.85	60	2.5
1.0	71	3
2.0	88	6
5.0	100	91
10.0	NA	100

.1 Gradation to be within limits specified when tested to ASTM C136 and ASTM C117. Sleeve sizes to CAN/CGSB-8.1, CAN/CGSB-8.2.

2.5 GRADATION ENVELOPE FOR LEACHING BED (T = 6-10 MIN/CM)

Grain Size (mm)	Lower Limit Percent Passing	Upper Limit Percent Passing
0.01	0	NA
0.05	5	0
0.25	10	1
0.50	15	2
0.85	20	2.5
1.0	40	3
2.0	70	6
5.0	90	91
10.0	100	100

.1 Gradation to be within limits specified when tested to ASTM C136 and ASTM C117. Sleeve sizes to CAN/CGSB-8.1, CAN/CGSB-8.2.

2.6 ACID SOLUBILITY

.1 Less than 5% total loss in mass after a 30-minute immersion in a hydrochloric acid (HC1) solution made by combining equal volumes of water and standard reagent grade 12.1 N (approx.) HC1.

2.7 FINES CONTENT

.1 Fines should not exceed 1.5% by weight. No organic material.

2.8 COURSE CONTENT

.1 There should be no course content (0% by weight).

2.9 FILTER FABRIC

.1 Terrafix 270R non woven polyolefin filter UV resistant fabric.

.2 Overlap fabric 300 mm. Lay fabric in direction of distributed pipe.

2.10 DISTRIBUTION PIPE

.1 Distribution Headers must be 75 mm diameter PVC pipe and fittings to CAN/CSA-B182.2 (non-perforated) and connect to the piping from the rotary valve chamber.

.2 Infiltration Pipe must be 75 mm diameter PVC pipe and fittings 40 perforated to CSA-C137.1. 4 mm diameter or free space equally along the length of pipe.

2.11 DRAINAGE PIPE

.1 Provide a 150 mm HDPE perforated drainage pipe complete with filter fabric along the entire toe of the raised leaching bed. Outlet the drainage pipe is shown on the contract drawings.

.2 At outlet install rodent trap.

.3 Bed the drainage pipe in 300 mm of leaching bed sand (T< 15 min/cm).

.4 Install tee connections at all corners of raised bed as shown on drawings for sampling.

.5 Refer to Part 2.12 for Observation Wells.

.6 Manufacturer Big “O” or approved equal.

.7 Provide shop drawings per Section of the Contract Documents.

2.12 OBSERVATION WELLS

.1 Install 100 mm T (non-perforated) complete with PVC/HDPE riser on the perimeter drainage pipe. Run observation pipe flush with surface.

.2 Provide lockable cap.

.3 Manufacturer Big “O” or approved equal.

.4 Provide shop drawings per Section of the Contract Documents.

2.13 LYSIMETERS

.1 Provide 100 mm diameter Schedule 80 PVC screen and casing slotted only in the area between the second sand layer and the extended sand layer (depth 900 mm). Total length 1.95 m ±. Slot size 0.040 on 0.25 inch spacing. Install Filter Sock around casing pipe.

.2 Number of lysimeters: 5 (five).

.3 Accessories:

.1 Bailer Emptying Devices: Quick emptying for stainless steel bailer.

.2 Bailer Brushes: quantity 2

.3 Bailer Cord: polypropylene, 3/16” diameter

.4 Bailer (reusable): 316L stainless steel, 75 mm diameter

.5 Manufacturer: Monoflex Baker Water System Division.

3 Execution

3.1 AREA TYPE DISPOSAL FIELD INSTALLATION

.1 Rough grade to depths as indicated. Remove rock as necessary to obtain grades as shown on drawings.

.2 When raised leaching bed is to be constructed on exposed rock, provide additional soil to meet the requirements of layers in Part 2.1.1.

.3 Place material in unfrozen condition as indicated.

.4 Leaching bed fill material (imported filter material) to have percolation rate as shown in Part 2.1.1 and be pre-approved by consultant prior to its mass importation to site (refer to Part 1.4.3 for mock-up area).

.5 Upon completion of placement of leaching bed fill, Engineer to conduct 6 in situ percolation tests in sand mound prior to proceeding with bed construction.

.6 Obtain consultant's approval to operate construction equipment across disposal field.

.7 Place minimum of stone material under entire bed.

.8 Connect lengths and place distribution pipe in the middle of the stone material as indicated.

.9 Place geotextile over stone as indicated.

.10 Connect each distribution pipe individually to rotary valve.

.11 Connect free ends of distribution lines.

.12 Maintain pipe elevations within 5 mm of inverts indicated.

.13 Do not cover disposal field area until pipe grade and alignment have been approved by consultant and Parks Canada Departmental Representative.

.14 Cover disposal field as indicated. Material to be approved by consultant. Do not compact. Overfill to allow for settlement.

.15 Grade areas surrounding disposal field bed as indicated, to provide for diversion of surface run off waters.

3.2 INSTALLATION AND INSPECTION

.1 Before placing the filter media, the leaching bed area shall be inspected and passed by the consultant.

.2 The filter media shall be installed as indicated on the Contract Drawings and as approved by the consultant.

.3 Thoroughly clear and grub the area where the filter media is to be installed of all waste rubble, roots, stumps, loose rock etc., before placing filter material.

.4 Provide the services of a licenced installer to inspect, test, and troubleshoot the installation.

.5 The licenced installer, mentioned above, will certify that the media is ready for operation before use.

.6 Arrange with the consultant a mutually agreeable date when the representative should be on site.

.7 Submit a report, signed by the licenced installer, describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance of media supplied. The report must verify that the filter media conform to all specifications.

3.3 SUPERVISION OF INSTALLATION AND COMMISSIONING

.1 The Contractor shall allow for supervision periods by a Geotechnical Engineer (retained by Contractor) to supervise the installation, start up commission and instruct operating personnel, and direct acceptance tests.

3.4 METHOD FOR PLACING FILTER MEDIA

.1 Review with the consultant, the method of media placement before attempting to install the media

.2 Protect all media from mixing with other grades of media or with extraneous materials

.3 Place filter media in layers to the depths as specified.

.4 Compact the filter needed in 90% SPD.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

.6 Section 01 61 00- Common Product Requirements

.7 Section 01 74 00 – Cleaning and Waste Management

.8 Section 01 74 21 – Construction Demolition Waste Management and Disposal

1.2 REFERENCES

.1 ASTM International

.1 ASTM C14M-07, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).

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

.3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.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 CSA International

.1 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.

.2 CAN/CSA G401-07, Corrugated Steel Pipe Products.

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS.MUNI 401 – Construction Specification for Trenching, Backfilling and Compacting

.2 OPSS.MUNI 421 – Construction Specification for Pipe Culvert Installation in Open Cut

.3 OPSS.MUNI 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Certification: to be marked on pipe.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

2 Products

2.1 CORRUGATED STEEL PIPE

.1 Corrugated steel pipe: to CAN/CSA-G401.

.2 Corrugated fluming: to CAN/CSA-G401.

2.2 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material to OPSS.MUNI 1010.

3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Parks Canada Departmental Representative and Consultant.

.2 Inform Parks Canada Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Parks Canada Departmental Representative and Consultant.

3.2 PREPARATION

.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 and sediment and erosion control drawings.

.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.

3.3 TRENCHING

.1 Do trenching Work in accordance with OPSS.MUNI 401.

3.4 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of maximum density to ASTM D698.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Parks Canada Departmental Representative and Consultant, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.5 LAYING CORRUGATED STEEL PIPE CULVERTS

.1 Begin pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.4 Do not allow water to flow through pipes during construction except as permitted by Parks Canada Departmental Representative and Consultant.

3.6 JOINTS: CORRUGATED STEEL CULVERTS

.1 Corrugated steel pipe:

.1 Match corrugations or indentations of coupler with pipe sections before tightening.

.2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.

.3 Insert and tighten bolts.

.4 Repair spots where damage has occurred to spelter coating by applying two coats of zinc rich paint.

3.7 BACKFILLING

.1 Backfill around and over culverts as indicated or as directed by Parks Canada Departmental Representative and Consultant.

.2 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.3 Compact each layer to 95% maximum density to ASTM D698 taking special care to obtain required density under haunches.

.4 Place backfill in unfrozen condition.

3.8 FLUMING

.1 Assemble and install fluming as indicated.

.2 Set top edges of fluming flush with side slope.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

END OF SECTION

1 General

1.1 INTENT

.1 This section covers the work (including design fabrication of pre-assembled packages, factory testing, supply, supervision of installation, on-site testing/commissioning/training and coordinated design responsibility for a biofiltration system to provide for the Cyprus Lake, Hub wastewater treatment system.

.2 Equipment furnished under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions and recommendations unless exceptions are noted by the Engineer.

1.2 SYSTEM DESCRIPTION/PERFORMANCE

.1 This specification outlines the requirements for the construction of a sewage treatment system for the following:

.1 Balanced peak daily sewage flow of 30,000 L/day with the following maximum influent sewage concentrations:

BOD = 190 mg/L

TSS = 210 mg/L

TP = 8 mg/L

.2 Guaranteed Effluent performance as follows:

cBOD = 10 mg/L

TSS = 10 mg/L

TP = 1 mg/L

.2 Refer to Section 3.2 for performance payment terms.

.3 Related works:

.1 The construction of the Biofilter system is a component of the new wastewater system.

.2 Additional related works include the new raised leaching bed, sanitary sewage main, and electrical supply.

1.3 RELATED REQUIREMENTS

.1 Section 01 29 00 – Payment Procedures

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 45 00 – Quality Control

.5 Section 01 79 00 – Demonstration and Training

.6 Section 33 36 33 – Utility Drainage Field

1.4 REFERENCES

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

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

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

.3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association, (CSA International)

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

.2 CAN/CSA-A23.4/A251, Precast Concrete-Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products.

.3 CAN/CSA-B66, Prefabricated Septic Tanks and Sewage Holding Tanks.

.4 CSA B1800, Plastic Non-pressure Pipe Compendium – B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

1.5 DESIGN REQUIREMENTS

.1 Design precast concrete wastewater utility holding tanks in accordance with CAN/CSA-B66, and to carry handling stresses and indicated service loads.

1.6 SUBMITTALS

.1 Submit under provisions of Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's data sheets on each product to be used, including, but not limited to, the following:

.3 Preparation instructions and recommendations.

.4 Storage and handling requirements and recommendations.

.5 Installation manual and operating guidelines.

.6 Shop Drawings: Tank manufacturer shall submit the following for review and approval prior to fabrication of the tanks:

.7 Detailed shop drawings of each tank complete with all accessories supplied by the manufacturer.

.8 Design calculations for items designed by manufacturer.

.9 Methods of handling and erection.

.10 Openings, sleeves, inserts and related reinforcement.

.11 No more than 10 percent of the price for supply of the biofilter system will be paid after acceptable review of shop drawings.

1.7 QUALIFICATIONS

.1 Manufacturers and erectors of precast concrete elements shall be certified by CSA as meeting requirements of CAN/CSA-A23.4/A251, for Category SC and SP products.

1.8 WARRANTY

.1 Provide a one year manufacturer’s warranty starting from the day of substantial completion.

.2 Warranty shall include all parts and labour, travel and lodgings as long as it takes to correct deficiencies.

2 Products

2.1 EQUALIZATION TANKS

.1 Two (2) 37,000 L reinforced precast concrete tanks.

.2 Tank #1 with 150 mm(Ø) sdr 35 sewer inlet and two (2) 610 mm(Ø) plastic charcoal vented insulated lids with access risers to grade.

.3 Two (2) 150 mm(Ø) sch 40 pvc bottom drain connections between tanks.

.4 Tank #2 with 50 mm(Ø) sch 40 pvc forcemain outlet, one (1) 610 mm(Ø) plastic charcoal vented insulated lid with access risers to grade, and one (1) 610 mm x 610 mm aluminum insulated access hatch with concrete riser to grade.

.1 Two (2) submersible grinder pumps (13.3amp/2.0hp/208-230V) with polypropylene lifting rope secured to the access lid.

.2 Float tree with three (3) mercury free float switches; timer enable, high level alarm #1, high level alarm #2 (see Section 2.7).

.3 150 mm, Schedule 10, stainless steel emergency pump out line with quick connect and blank off fitting installed in equalization Tank #1 (as shown on drawings). Depth into tank to 300 mm from bottom of tank.

2.2 ANAEROBIC DIGESTER TANKS

.1 Two (2) 46,365 L reinforced precast concrete tanks.

.2 Tank #1 with 100 mm(Ø) sdr 35 sewer inlet & outlet and two (2) 610 mm(Ø) plastic insulated lids with access risers to grade.

.1 3,000 L InnerTube.

.3 100 mm(Ø) sdr 35 sewer pipe connections between tank at 2% slope.

.4 Tank #2 with 100 mm(Ø) sdr 35 sewer inlet & outlet, three (3) 610 mm(Ø) plastic insulated lids with access risers to grade, and one (1) 610 mm x 610 mm aluminum insulated access hatch with concrete riser to grade

.1 3,000 L InnerTube.

.2 Six (6) EC-P- non-chemical dosing phosphorous removal system, iron electrode assemblies (1amp/115V) with lift-out assembly.

.3 Two (2) effluent filters each rated for 37,850 L/day.

2.3 PUMP TANK

.1 One (1) 27,500 L reinforced precast concrete tank.

.2 100 mm(Ø) sdr 35 sewer inlet, 50 mm(Ø) sch 40 pvc forcemain outlet, one (1) 610 mm(Ø) plastic charcoal vented insulated lid with access risers to grade, and one (1) 610 mm x 610 mm aluminum insulated access hatch with concrete riser to grade.

.3 50 mm(Ø) sch 40 pvc forcemain outlet, one (1) 610 mm(Ø) plastic charcoal vented insulated lid with access risers to grade, and one (1) 610 mm x 610 mm aluminum insulated access hatch with concrete riser to grade.

.1 Two (2) submersible effluent pumps (9.7amp/0.5hp/208-230V) with polypropylene lifting rope.

.2 Float tree with two (2) mercury free float switches; timer enable, 75% high level alarm/timer override.

2.4 BIOFILTER TANKS

.1 Four (4) 27,500 L reinforced precast concrete tanks.

.2 Tank #2, #3, and #4 with 50 mm(Ø) sch 40 pvc forcemain manifold with spray nozzles, two (2) 610 mm(Ø) plastic charcoal vented insulated lid with access risers to grade, and one (1) 610 mm(Ø) plastic insulated lid with access riser to grade.

.1 Two (2) wire mesh baskets each with 10.5 m3 polyurethane Biofilter treatment medium.

.2 610 mm(Ø) plastic basin with access risers to grade with air fan (0.18amp/115V).

.3 Two (2) 150 mm(Ø) sch 40 pvc bottom drain connections between tanks.

.4 Tank #1 with 50 mm(Ø) sch 40 pvc forcemain manifold with spray nozzles, two (2) 610 mm(Ø) plastic charcoal vented insulated lid with access risers to grade, and two (2) 610 mm x 610 mm aluminum insulated access hatch with concrete riser to grade.

.1 Two (2) wire mesh baskets each with 10.5 m3 polyurethane Biofilter treatment medium.

.2 610 mm(Ø) plastic basin with access risers to grade with air fan (0.18amp/115V).

.3 Four (4) submersible effluent pumps (9.7amp/0.5hp/208-230V) with polypropylene lifting rope.

.4 Float tree with three (3) mercury free float switches; timer enable #1, timer enable #2, high level alarm/timer override.

2.5 FLOW METER CHAMBER

.1 One 1.0 m PPE basin with a 610 mm(Ø) plastic basin with access riser to grade with 50 mm(Ø) sch 40 pvc forcemain inlet and outlet.

.1 One (1) insertion fitting and electromagnetic flow transmitter.

.2 One (1) multifunction transmitter/controller outside of the chamber and installed within the main control panel.

.3 Isolation valves complete with bypass connection for removal of flow meter.

2.6 ROTATING VALVE CHAMBER

.1 One (1) low PPE basin with a 610 mm(Ø) plastic basin with access riser to grade with 50 mm(Ø) sch 40 pvc forcemain inlet and outlet

.1 One (1) 4-cam rotating valve (blank off 4th outlet as necessary).

2.7 SMART PANELS

.1 Where required, shall be CSA approved and carry a CSA approved label.

.2 Panels shall be an automatic duplex pumps/simplex pump controller.

.3 120/240VAC / 1 phase / 60 Hz,

.4 NEMA 4x rated enclosure, with formed hinge front door to open 90 degrees for full inside access.

.5 Panels shall be PLC controlled with remote monitoring and control functionality.

.6 Panels shall be specifically designated for control of the wastewater/effluent pumps and blowers.

.7 Alarm re-initiates after a delay time (quiet time). An email notification is sent every time the alarm initiates.

.8 Provide data logging of ON times, current, and pump ON/OFF status.

.9 The alarm circuit has a battery backup, independent of mains power.

.10 NEMA Type 4X FIBOX CAB 500x400 panel enclosure.

.11 1.8 x 1.8 x 0.6 m stainless steel lockable enclosure NEMA 4X rated to house all smart panels.

.12 Cellular GPRS connection for remote control and monitoring of system status.

.13 Programmable Logic Controller (PLC) for process control of pumps, EC-P and fans.

.14 Programmable Logic Controller (PLC) to interface with float switches, flow meters, and auxiliary alarm circuits.

2.8 MAIN CONTROL PANEL (MCP)

.1 The MCP is to house all necessary power distribution and control equipment to operate the biofilter sewage treatment system.

.2 The MCP shall contain the following:

.1 Main power disconnect (200A, 120/240VAC, 1 phase, 3 wire) for incoming feed from HUB distribution panel,

.2 Power distribution panel for electrical feeds to treatment system equipment and ancillary panel devices,

.3 Smart panels for control of the pumps, fans and EC-P,

.4 Cellular (GPRS) communication for remote control and monitoring of system,

.5 including power supply, level controls, inside lights, heater, fan, alarm beacon and lockable enclosure and power and control feeds to and from each pump.

.3 The MCP is to be located in a non-hazardous area and is to be industrial quality heavy gauge, stainless steel, free standing, dual door enclosure meeting EEMAC 4X requirements. (properly sized by the supplier/Contractor to include all components and required spares).

.4 The panel is to include fully hinged double door capable of opening at least one hundred and thirty five (135) degrees for full access to all backplate mounted devices. The panel is to come complete with a quarter turn 3-point latches and a padlock hasp. Panel to be surface mounted to a concrete pad by General Contractor.

.5 Ancillary panel devices to be provided within the MCP shall include:

.1 A thermostatically controlled heater to maintain temperature above dew point,

.2 A 20A, 120V GFCI duplex receptacle (for general use), and

.3 An LED light fixture with toggle switch control (for interior panel light).

.6 The panel is to be supplied by the pump manufacturer, who shall be responsible for co-ordination of all devices to ensure the system is complete.

.7 Ensure that all components are CSA approved and that the panel carries a CSA approval. All electrical equipment, wiring, grounding, and testing for this project must meet the Ontario Electrical Safety Code including all bulletins issued by the Electrical Safety Authority applicable to this project.

.8 Provide all conduit, wiring, junction boxes for complete electrical and instrumentation system.

2.9 SPARES

.1 Provide the following spares:

.1 Raw sewage grinder pump (1)

.2 Effluent pump (1)

.3 Air fan (1)

.4 Effluent filters (1)

.5 Mercury free float switches (3)

2.10 ACCEPTABLE MANUFACTURERS

.1 All products associated with the biofilter sewage treatment system shall be supplied by Waterloo Biofilter Systems Inc., Rockwood, Ontario 519 856-0757 ext. 180 as a base bid.

.2 Engineered approved equivalent.

3 Execution

3.1 PREPARATION

.1 Verify that the field conditions are acceptable and the facilities are ready to receive the work.

.2 Remove all construction debris from the interior of all vessels.

.3 DO NOT apply any coating or material to the tank interior without written approval of the supplier and the Engineer.

.4 Verify items provided by others are properly sized and located.

.5 Hydrostatically test all tanks, pipes and valves.

.6 Repair leaks or indication of leaks. Retest all items in .5 above after repair.

.7 Backfill all vessels with Granular B material. Install all vessels on 150mm layer of Granular A. Compact all granular to 95% SPD.

.8 Remove rock to sufficient depth and width to install all vessels as shown on the drawings.

.9 Coordinate the construction start-up and commissioning with the construction of the comfort station and the installation of the raised leaching bed.

3.2 PERFORMANCE TESTING

.1 The Owner will retain 10 percent of the cost to supply and install the system until performance compliance has been achieved.

.2 Performance testing shall begin one month after the Biofilter system begins operation in accordance with the supplier recommendations.

.3 A minimum of monthly Biofilter effluent samples are to be taken. Samples are to be taken from Biofilter Tank #4. Each sample will include a test for:

.1 cBOD5

.2 TSS

.3 TP

.4 TN (TAN + Nitrate + Nitrite) – not in performance guarantee

.4 All analytical work shall be the responsibility of the Owner.

.5 All analytical data shall be sent to the Owner, Engineer and supplier within 15 days of completion.

.6 Exceedances shall result in remedy by supplier within 30 days of notification to the supplier.

.7 The Owner shall conduct a performance review on a monthly basis.

.8 Any 3-month rolling average for all parameters that achieves the performance from 1.2.1.2, results in compliance being achieved.

.9 Upon successfully achieving compliance, the Owner will release the final payment.

.10 If after the warranty period, compliance has not been achieved, but either of the balanced peak daily sewage flow or maximum influent sewage concentrations are exceeded, the Owner will release the final payment.

.11 If after the warranty period, effluent compliance with 1.2.1.2 has not been achieved, performance testing shall continue on a monthly basis until compliance has been achieved. Upon successfully achieving compliance, the Owner will release the final payment. Owner shall conduct performance testing for the duration of the warranty period on a quarterly basis.

3.3 SUPERVISION COMMISSIONING, TRAINING

.1 Provide services of factory trained service technician specifically trained on type of equipment specified.

.2 Service technician must be present on site for all items tested below. Person-day requirements listed are inclusive of travel time and does not relieve the Contractor of the obligation to place equipment under inspection.

.1 Installation checks:

.1 During installation checks, confirm that all alarms and status signals are registering at the appropriate smart panel, confirmed on the Owners cell phone and at the vendor's remote facility. Confirm from the vendors facility that all the status and alarms can be acknowledged and new set points be downloaded to the appropriate smart panels.

.2 5 days of installation operation.

.3 Qualified service technicians shall carry out all service.

.4 Provide written service reports within 15 days of site visit.

.5 Start-up.

.2 Functional Completion Testing:

.1 5 days completing all equipment check tests.

.2 Provide written reports per Part 3.2.3.

.3 Field Performance Testing:

.1 During installation checks, confirm that all alarms and status signals are registering at the appropriate smart panel, confirmed on the Owners cell phone and at the vendor's remote facility. Confirm from the vendors facility that all the status and alarms can be acknowledged and new set points be downloaded to the appropriate smart panels.

.2 See Section 3.2.

.3 5 days on site.

.4 Provide written report after testing per Part 3.2.3.

.4 Vendor Training:

.1 During installation checks, confirm that all alarms and status signals are registering at the appropriate smart panel, confirmed on the Owners cell phone and at the vendor's remote facility. Confirm from the vendors facility that all the status and alarms can be acknowledged and new set points be downloaded to the appropriate smart panels.

.2 2 days on site after functional testing.

.3 Re-training – 2 days, 6 months after system has been operational.

.4 Provide written training manual one month prior to start-up.

.5 During installation checks, confirm that all alarms and status signals are registering at the appropriate smart panel, confirmed on the Owners cell phone and at the vendor's remote facility. Confirm from the vendors facility that all the status and alarms can be acknowledged and new set points be downloaded to the appropriate smart panels.

.6 Post Commissioning Unit:

.1 2 visits (4 day duration during the first year of installation).

.2 Provide written report per Part 3.2.3.

3.4 MAINTENANCE

.1 Supplier to provide for ongoing operation and maintenance service including remote monitoring during the warranty period.

.2 Provide preliminary contract documents to Owner during shop drawing submission for review by Engineer and Owner.

END OF SECTION

1 General

1.1 NOT USED

2 Products

2.1 MATERIALS

.1 Round Timber Posts

.1 Species: Eastern White Cedar

.2 Dimensions: 150 mm diameter x 2.4 m long

.3 Dimensions :150 mm x 150 mm square x 2.4 m long

.4 Height of posts above grade: 1.2 m

.5 Straight, free from loose or unsound knots, short crooks, reverse sweep, shakes, rot, and season checks that exceed 6mm in width. Defects shall be defined as CAN3-O56.

.6 Trim existing knots flush with surface

.2 Manila Rope

.1 32 mm dia. Manila rope.

.2 316 Stainless steel snap with eye.

.3 Routing Eyebolt, 6.5 mm wire dia., w/12.5 mm dia. eye dia. Thread length 38 mm, shank length 72 mm.

3 Execution

3.1 INSTALLATION

.1 Location of posts are shown on the drawings however shall be confirmed by the Parks Canada Department Representative.

.2 Excavate post holes to a minimum of 300 mm diameter and compact hole to provide firm foundation. Set post plumb and backfill with excavated material in 150mm layers. Compact each layer before placing the next layer.

.3 If bedrock is encountered, drill a hole into solid and secure bedrock 200 mm deep and secure a saddle dowel with a non-shrink epoxy grout. Shape bottom of round post square to fit into the saddle and secure with a bolt thru the saddle and post.

.4 Attach a 316 stainless steel snap with eye to each end of the rope for attachment to the receiving routing eyebolt on the building and the wood post.

3.2 CLEANING

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

END OF SECTION

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Appendix A

Unit Price Form

APPENDIX A - UNIT PRICE FORM

UNIT PRICE TABLE

The Unit Price Table designates Work to which a Unit Price Arrangement applies.
(a) Work included in each item is as described in the referenced specification section.
(b) The Price per Unit shall not include any amounts for Work that is not included in that unit price Item.

Item No.	Specification Reference	Class of Labour, Plant or Material	Unit of Measur -ement	Estimated Quantity (EQ)	Price per Unit applicable* tax(es) extra (PU)	Extended amount (EQ x PU) applicable tax(es) extra
1	31 22 13	Supply all labour, materials, place & compact of Granular 'B'.	tonne	1	$	$
2	31 22 13	Supply all labour, materials, place & compact of Granular 'A'.	tonne	1	$	$
3	31 22 13	Supply all labour, materials, place & compact Hot Mix Asphalt per details and OPSS 310:	tonne	1	$	$
4	32 14 13	Supply, all labour, materials, place & compact granular base material, in fill drainage material and permeable precast concrete paving and edge restraint. Payment for the permeable precast concrete paving shall be per square meter.	M2	1	$	$
5	03 35 33	Supply, all labour, materials, place & compact granular base material and random pattern limestone stamped concrete. Payment for the concrete paving shall be per square meter.	M2	1	$	$
					TOTAL EXTENDED AMOUNT (TEA) Excluding applicable tax(s)	

TOTAL BID AMOUNT (TLSA +TEA) Excluding applicable tax(es)	

Note: Bidders are reminded that it is their responsibility to include in their bid all work as described in the drawings and specifications.

* Costing to include all disbursements (identified and implied)

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Appendix B

GM BluePlan Engineering Geotechnical Investigation

Prepared By:

Geotechnical Investigation - Cyprus Lake Campgrounds
Bruce Peninsula National Park – Tobermory, ON

Parks Canada c/o AECOM Canada Ltd.

GMBP File: 217291

October, 2017

Parks Canada Parcs Canada

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA

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PARKS CANADA C/O AECOM CANADA LTD.

GEOTECHNICAL INVESTIGATION - CYPRUS LAKE CAMPGROUNDS

OCTOBER, 2017

GMBP FILE: 217291

1. INTRODUCTION

Parks Canada is proposing five component upgrades at the Cyprus Lake facility within Bruce Peninsula National Park (GMBP - Figure No. 1). Parks Canada has issued a proposal document for these proposed upgrades, which are identified as the following:

- **Component #1 – "The Hub"** (Community Facility with full service washrooms/showers, parking and outdoor activities).
- **Component #2 – EE-1** (Buried electrical corridor located in the Birches Campground).
- **Component #3 – EE-2** (This component is included within the Park's proposal document, but is only included as a feasibility element at the design stage and may be addressed at a later date).
- **Component #4 – Electrical Backup** (This component is included within the Park's proposal document, but is only included as a feasibility element at the design stage and may be addressed at a later date).
- **Component #5 – Washroom Facilities (x9)** (The proposed individual washroom facilities are located within the existing three campgrounds - Tamarack, Birches, Poplars).

Based on the outlined works within the aforementioned proposal document, GM BluePlan Engineering Limited (GMBP) was contacted by Parks Canada consultant – AECOM Canada Ltd. (AECOM) to complete a geotechnical investigation using shallow excavated testholes for Components #1, #2, and #5. It should be noted that EE-1 (Component #2) is a proposed underground electrical corridor, and findings of the geotechnical investigation and recommendations for this component have been presented in a letter report by GMBP dated September 12, 2017. As a result, the remaining investigative findings and recommendations are presented to assist with the design of the structural buildings components and the sewage system in Component #1 and #5.

The purpose of the geotechnical investigation was to assist Parks Canada staff and their consultants with the structural and civil design of the various elements of the above noted project components.

It was agreed that the initial geotechnical investigation was primarily to investigate the shallow soil overburden and the interface of the bedrock. It should be noted that rock coring did not form part of the initial scope and is considered a separate task. Additional geotechnical investigations to assess the deeper seated bedrock would be determined based on the review of initial shallow investigations.

Based on the preliminary concept layout drawings provided by AECOM (which are enclosed as Figures to this report), the areas of development are identified and locations are as follows:

- New "Hub" Building – Located opposite to The Birches Campground entrance, and is currently a gravel lot which is being used as a centralized garbage collection depot for the Birches Campground (Located on the eastern side of Cyprus Lake Road).

- Tamaracks Campground washrooms (x4)
  - Replacement of Existing Buildings #3/4
  - Replacement of Existing Buildings #5/6
  - Replacement of Existing Buildings #7/8
  - Replacement of Existing Buildings #9/10

- Birches Campground washrooms (x3)
  - Replacement of Existing Buildings #13/14
  - Replacement of Existing Buildings #24
  - Proposed Building – Campsite #155

- Poplars Campground washrooms (x2)
  - Replacement of Existing Buildings #15/16
  - Replacement of Existing Buildings #17/18

These concept layout drawings were provided by AECOM and are attached for additional reference.

The field investigation included completing testholes in proximity to the proposed location of the "Hub", washrooms, and the proposed sewage system area. The purpose of the investigation is to comment on the soil bearing capacity and suitability for foundation construction for the proposed buildings. In addition, a review of the subgrade conditions for the sewage system and the "Hub" parking lot construction; and subsequent recommendations for the reuse of any excavated soils are to be considered.

2. BACKGROUND

2.1 Site Location and Features

Cyprus Lake Campground is located within the Bruce Peninsula National Park, just south of Tobermory and is accessed from Highway 6. The campgrounds border the shores of Cyprus Lake, and the Campgrounds also provide access to "the Grotto" and Lake Huron via interconnected trails and the head of the trails parking lot.

The Campgrounds are generally divided into three un-serviced camping areas, which are operated by Parks Canada. In addition to a relatively new reception building (located near the Campground entrance), there are three campgrounds named; Tamaracks, Birches & Poplars. These campgrounds generally have a few gender specific washroom buildings with basic features (toilets, showers and sinks), which are located in centralized locations across each campground.

2.2 Geology and Physiography

The "Physiography of Southern Ontario", Chapman and Putnam, 1985 identifies the Cyprus Lake site as within the "Bruce Peninsula" physiographic region. Aside from a few localized features, this area is generally characterized by very little overburden on the irregular grey dolostone bedrock. The dip of the bedrock is toward the west, sloping upwards from the Lake Huron shore to the Georgian Bay shore on the peninsula. The shore of the Bruce Peninsula on Lake Huron is low lying with boulders, gravel and sand bars. There are also some finger strips of wetlands that extent inland. The Soil Survey within Bruce County indicates the surficial soils as mainly bare bedrock with small pockets of soil or muck scattered in the area. The thin layer of overburden soil is also noted by the Ministry of Environment (MOE) well records, where rock is encountered within as a little as one foot from the surface in many of the wells.

3. SITE INVESTIGATION

3.1 Fieldwork

An initial site meeting was conducted on August 30th, 2017, to meet with Brandon Golden of Parks Canada and various personnel from AECOM, who are the project design consultants. In addition, a representative from SMC Geomatics also attended the meeting to identify the topographic survey requirements for the various proposed structures and land development across the site(s). In addition to the conceptual plans (enclosed), a base plan showing elevations will be prepared by SMC Geomatics in conjunction with AECOM for the proposed works. During this meeting the proposed testhole locations were generally selected and the existing utility locations were clarified by Parks staff, to ensure no conflicts will present during the excavation of the investigative testholes.

Following the September long weekend (Labor Day), the testhole excavations were completed on September 5th, 2017, using a John Deere mini track-mounted excavator (model JD27c). A series of eight (8) shallow testholes were excavated in the area of the proposed "Hub" building, septic and parking area. Also, a series of four (4), three (3), and two (2) testholes were excavated in the Tamaracks, Birches, and Poplars campgrounds respectively for the proposed separate washroom facilities. The locations of the testholes are presented on the attached respective Testhole Location Plans in Appendix 'A' of this report.

The subsurface conditions were observed by the field staff and selected soil samples were collected for laboratory testing and further classification. While the excavations were occurring, the subsurface soils were probed with a steel rod to infer the relative compactness of the subgrade soils.

The soil and groundwater conditions observed in the field were logged and recorded as shown on the attached Testhole Logs in Appendix 'B'. As noted above, the ground surface at each testhole was surveyed and related to the site benchmark by SMC Geomatics.

3.2 General Sub-Surface Conditions

To assist with general review of the data, we have summarized the soil and bedrock conditions at each area as follows:

3.2.1 "HUB"

As shown on the attached Testhole Location Plan (GMBP – Figure No. 2), Testholes No. 1 and 2 were located in the vicinity of the proposed septic field for the "Hub" building. Testhole No. 3, 4 and 5 were located in the vicinity of the proposed building. As well, Testhole No. 4 was near the proposed electrical transformer for the proposed "Hub" building. Testhole No. 6, 7 and 8 were located in the area of the proposed parking lot and the elliptical roadway for accessing the "Hub" building.

Except for Testhole No. 8 which encountered rock at the surface, the Testholes in the Hub area varied in depth from 0.5m to 1.2m. The stratigraphy encountered in Testhole No. 1 revealed surficial topsoil underlain by silty sand with trace gravel, underlain by clayey silt till, which was ultimately underlain by bedrock. Testhole No. 2 encountered similar subgrade stratigraphy, but without the lower layer of the clayey silt till with sand gravel and cobble layer above the bedrock. Soil samples were obtained from Testholes No. 1 and Testhole No. 2 to determine the grain size of the soils and to determine a percolation rate (T-time using the Hazen Formula) for the collected samples. Results are attached in Appendix 'C'. However, it is noted from the recorded surface elevations of Testholes No. 1 & 2 that there is 0.80 meters of elevation difference and the inferred bedrock contact elevations between these Testholes has an elevation difference of 1.42 meters in the same gradient.

In general, the sub-surface conditions across the remainder of the "Hub" site consist of similar soils as noted above in the septic bed location, with decreasing soil overburden thickness to the bedrock as the exploratory testholes progressed northerly across the "Hub" site. It should be noted that the soil thickness at Testhole No. 3 (southern side of "Hub" site) was 1.0 meter thick and Testhole No. 8 (northern side of the parking area) encountered bedrock at surface. In areas were imported granular fill exists at the surface (Testhole No. 4 and No. 7), it appears that the historic topsoil layer was not removed prior to the installation of the granular fill, as a blended matrix of organics and gravel exists above the bedrock.

3.2.2 Campground Washroom Facilities

Tamaracks:

The locations of the testholes are presented in Appendix 'A' – Figure L-5. As shown on the attached Testhole Logs, the investigative testholes were generally able to be extended to depths ranging between 0.40 to 1.70m prior to inferred bedrock contact.

The removable soils encountered are generally summarized as surficial granular fill (existing road/paths), underlain or mixed with organics, which are underlain by silty sand with trace gravel and/or clayey silt till with sand, gravel and cobbles.

Birches:

The locations of the testholes are presented in Appendix 'A' – Figure L-6. As shown on the attached Testhole Logs, the two southern most investigative testholes (Birches -155 & Birches-24) extended through a thin surficial layer of sand and gravel fill (0.15 – 0.30 meter thick) and contacted the underlain bedrock. The third testhole (Birches 13/14) was able to be advanced 1.5 meters below surface. This testhole encountered various layers of surficial fill above the trapped layer of organics prior to encountering the native undisturbed silty sand with gravel and cobbles. Underlain to these soils exists the inferred bedrock.

Poplars:

The locations of the testholes are presented in Appendix 'A' – Figure L-8. As shown on the attached Testhole Logs, the investigative testholes generally extended through surficial fill and trapped organic layer, prior to encountering native undisturbed soils. The southernmost testhole (Poplars 15/16) encountered weathered bedrock directly below the layer of organics. The northernmost testhole (Poplars 17/18) encountered a 0.40 meter thick layer of clayey silt till with gravel and cobbles prior to contacting the bedrock.

3.3 Summarized Subsurface Conditions

While the attached Testhole Logs are to be referenced for detailed stratography at each testhole, the following summarizes the findings as per various layers.

3.3.1 Topsoil and Organics

Topsoil and organic soils along with other deleterious materials were encountered at surface in the undeveloped areas. Where historical developments (mainly roadways) exist, trapped layers of organics exist below the installed fill materials, as the organics were not typically removed prior to the installation of fill. Based on the recorded soil stratigraphy, the organic layers range in depths between 0.05 meters to 0.30 meters in thickness across the various sites within the project scope.

3.3.2 Sand and Gravel Fill

The testholes excavated in the existing gravel driveway within the "Hub" area encountered surficial imported sand and gravel fill layer (generally 19 mm crushed granular) that was 0.15m in thickness and was generally underlain by a layer of mixed organics.

Generally all of the testholes excavated for the washroom building were located directly adjacent to the existing roadways and pathways surrounding the proposed washroom buildings.

Therefore, where this surficial imported gravel fill exists, it is generally 19 mm crushed granular and ranges between 0.15 to 0.30 meters in thickness. It was also noted that this surficial fill is underlain by either a layer of mixed organics or directly underlain by bedrock.

3.3.3 Sand Fill

Sand fill was only encountered in the testholes at Birches 13/14 & Poplars 17/18. This layer of fill presented as both brown and grey in colour and was noted to be fine graded. In both locations the sand fill layer was located above the historical surficial organic and ranges in thickness between 0.15 to 0.25 meters.

3.3.4 Silty Sand with trace Gravel

Within the "Hub" investigation, reddish brown silty sand with trace gravel was encountered in the southern portion of the investigative area. Generally, these soils exist directly below the surficial organics. These soils are generally present in the proposed septic area and the proposed building area (southern and eastern portions of the "HUB" site), and range in thickness between 0.20 to 0.50 meters. Based on the in-situ density, these soils are considered to be in a loose to compact state and laboratory moistures confirm in-situ moisture levels ranging between 8.8% to 12.4%.

Due to the existence of these soils in the proposed septic field location, grain-size determinations were completed on samples collected from HUB-TH-1 (0.4mbgs) & HUB-TH-2 (0.3mbgs). Based on these gradation results (enclosed in Appendix 'C' for additional reference), the soil composition appears to consist of 83.9% to 85.2% granular content (sand and gravel), with 14.8% to 16.1% plastic soil content (silt and clay). The findings are discussed in the septic design section of this report.

Within the proposed washroom facilities, the silty sand with trace gravel soils were only encountered in Tamaracks 5/6 and Tamaracks 7/8 locations. It is noted that these soils also exist directly below the surficial organics and either overburden clayey silt till or bedrock. However, the thickness of these soils was noted to range between 0.20 meters (at the Tamaracks 5/6 location) to 0.70 meters thick (at Tamaracks 7/8 location).

3.3.5 Silty Sand and Gravel with Cobbles

A layer of brown silty sand and gravel with cobbles was only encountered in the testhole located at Birches 13/14 site. This layer of soil was noted to underlay the historical organic layer which is underlain to existing surficial fill. At this location, the silty sand and gravel with cobbles was noted to be well graded and was in a moist (7.0% moisture content) and compact state. These soils presented in a relatively thick band (minimum of 1.05 meters thick). A boulder or bedrock was encountered, resulting in the termination of the investigative testhole at that depth.

3.3.6 Clayey Silty Till with Sand, Gravel and Cobbles.

Brown and grey clayey silt till with sand, gravel and cobbles was encountered in testholes HUB-TH-1, 3, 6. In addition, similar soils were also encountered at Tamaracks-3/4, 5/6, 7/8, and Poplars-17/18.

In all occurrences, these soils were in a dense to very dense state and were encountered directly above the underlain bedrock. The collected sample from HUB-TH-1 was found to have a moisture content of 8.9%.

This same sample was also tested for grain-size determination, as these soils exist within the proposed septic envelope. Based on the soil grading completed in our laboratory, the soil consists of 10.4% gravel, 42.0% sand, 34.8% silt and 12.8% clay.

3.3.7 Bedrock (Weathered)

Weathered bedrock was generally encountered across the entire site, and was typically located below the removable soils and above the intact bedrock. This "weathered" bedrock was able to be excavated with some effort using the JD 27c excavator and typically revealed 50 mm thick bedding planes. However, the thickest layer of weathered bedrock encountered in the testholes was only 0.20 meters thick.

3.3.8 Bedrock (Competent)

Bedrock was encountered across the entire site, and was typically the cause for the termination of the investigative testholes. The bedrock is considered as "competent" based on the evidence of massive particles and the integrity of the surface and resistance when attempting to excavate the rock or a fissure or crevice to continue advancing the excavations. Based on the observations, the removal of this rock would require rock removal equipment (ie: hoe-ram) to fracture the rock and unconfine the rock for removal by excavation.

3.4 Groundwater Conditions

In general, the investigative testholes were relatively dry with the soils generally being reported as moist. However, a minor groundwater condition was encountered in the testholes at Poplars 17/18 at 0.5m bgs. This minor infiltration was attributed to a "perched" condition between the interface of the surficial organic layer and the subgrade soils.

Based on the observations, significant amounts of groundwater are not anticipated at the depths required for the shallow foundation elements or the proposed tank installation if kept in the overburden or shallow bedrock. Trapped and perched water may be encountered locally.

4. DISCUSSION AND RECOMMENDATIONS

4.1 'Hub' and Washroom Buildings

<u>'Hub'</u>

Based on the conceptual designs and discussions with the AECOM design team and client representative, the proposed 'Hub' building will be constructed as two buildings with a covered breezeway between.

The facilities are understood to include seasonal shower facilities (including accessible), washrooms, laundry facilities, indoor and outdoor recreation areas, along with associated parking for the facility. Based on this conceptual design information and the seasonal usage, it is understood that a frost protected foundation with an interior slab-on-grade will be the considered for the proposed 'Hub' building structure.

Due to the potentially significant water usage from the 'Hub' building and its facilities, it is understood that a large sewage system (> 10,000 L/day flows and conceptual septic field of approximately 50m x 90m) will be required to handle the wastewater and effluent from the proposed building. However, to reduce the overall effluent output, it is understood that a grey water system may also be constructed and outlet under the proposed parking area to the north of the 'Hub' building location. It should be noted that the grassed surface of the septic area is being considered to be utilized as an outdoor activity area, with surficial features installed for public use.

Washrooms

It is understood that these washrooms are will be approximately 7.3 meters by 9.5 meters with a proposed 22730 L (5000 gal) shallow profile buried holding tank. Based on these dimensions, the proposed washrooms will be approximately 2.5 times larger than one of the existing structures. With most of the washroom sites, the proposed washroom buildings should fit within the extent of the current clearings. Unlike the historical washroom buildings, where the tanks are installed under the buildings, it is proposed to have the tanks installed across the access roads in the clearings where the other washroom will be removed.

With the holding tank being separated from the building structure, structural frost protected foundations (including any internal piers, as it is understood to be a seasonal unheated building) are recommended. It is understood that the interior of the building will have an insulated slab-on-grade. It is expected that, historical disturbances (in areas where the existing washrooms have tanks approximately 1.5 meters in depth installed below the current structures) will have to be addressed with either deeper foundations or engineered compacted fill to ensure the newly proposed structure has suitable and uniform structural bearing.

4.1.1 Foundation Loading

'Hub'

For preliminary discussion purposes, it is assumed that the area of the proposed 'Hub' building would be built up using imported compacted fill, with the proposed building floor to be near an elevation of 200.00m. With typical 1.5 meter deep frost protected foundation walls, the theoretical grade for the building footings would be near the existing ground surface. With the presence of historical granular fill and the potential for unstripped organic soils at or near this anticipated footing elevation, it is recommended that the site be stripped of any organic and deleterious soils and the grade raised with imported granular fill.

The granular is to be compacted to 100% of the material's Standard Proctor Maximum Dry Density (SPMDD) and be installed in lifts, not exceeding 300mm in thickness. Compaction testing (typically conducted by a third party geotechnical consultant) will be required to verify the compacted densities to permit the required foundation loading.

With the required densities verified on the installed granular fill, a bearing capacity of 150 kPa at Serviceability Limit State (SLS) and 210 kPa at Ultimate Limit State (ULS) can be utilized for design purposes.

Depending on the selected finish floor grade, the 'Hub' foundations may also encounter bedrock at the proposed foundation depths. Upon the quality of the bedrock being confirmed by a geotechnical consultant, is also anticipated to permit a bearing capacity of 150 kPa at Serviceability Limit State (SLS) and 210 kPa at Ultimate Limit State (ULS).

If greater design bearing capacities are required for the design, a follow-up review can be considered for isolated pier footings placed on competent rock.

Washroom Facilities

Based on the current site grading of the washroom areas, a 1.5 meter deep frost protected foundation wall and footing is recommended, so the proposed foundation will extend below the level of disturbance from the existing washroom structures. Deeper footings or engineered fill may be required in areas of the holding tanks. Therefore, the proposed foundations are to be located below any historical surficial installed fill, and would likely contact competent clayey silt till (with sand, gravel and cobbles) or bedrock. Based on the anticipated footing elevations, a bearing capacity of 150 kPa at Serviceability Limit State (SLS) and 210 kPa at Ultimate Limit State (ULS) can be utilized for design purposes.

4.1.2 Slab-On-Grade Construction

It is anticipated that both the "Hub" complex and the proposed campground washrooms designs will include a concrete slab-on-grade floor. As a result, the entire area of the buildings will have to be stripped of surficial fill and/or topsoil and of any underlying layers of organic material that may have been covered by fill. The backfill material under the slab should consist of imported Granular 'B' meeting OPSS 1010 Type 1 or 2, and be compacted in 200mm layers to 98% of the material's Standard Proctor Maximum Dry Density (SPMDD).

As a moisture break and leveling course, 0.20m of Granular 'A' should be placed and compacted to 98% SPMDD for the final granular layer.

4.1.3 Seismic Design

As per 4.1.8.4 of the Ontario Building Code (OBC), site classification for the underlying ground shall conform to Table 4.1.8.4A.

While the bedrock is at or near surface in the general area, the shallow footings would be placed in the upper undisturbed soil or imported engineered fill, and therefore, the Site Class for the "Hub" building and proposed washrooms is interpreted to be "D". The associated parameters should be reviewed by the Structural Engineer as part of the design for the project works.

4.1.4 Excavation and Backfill

As previously indicated, it is anticipated that the "Hub" building floor and grading will be raised significantly and therefore, excavations should be near the existing surface and straight forward.

The proposed individual campground washrooms will likely encounter different excavation conditions as these structures will be replacing the existing structures which have ±1.5 meter deep holding tanks below the superstructure, with the holding tanks acting like the foundations. Since the proposed washrooms are greater than 2 times the floor area of the existing washrooms, it is expected that the excavations will extend beyond the limits of disturbance from the historical holding tank/washroom installations.

Nevertheless, the on-site soils to be excavated can be classified as follows in accordance with the Ontario Health and Safety Act (OSHA) for Constructions Projects (Regulation 213/91).

Loose to Compact Silty Sand with Gravel ..... Type 3
Dense Clayey Silt Till with Sand, Gravel & Cobbles ..... Type 2
Upper Weathered Bedrock ..... Type 1

Where the excavations are made in the encountered fill or the silty sand with trace gravel, the excavation is to be cut back at an angle of 45° from the bottom of the excavation or from the rock interface. If the excavations are made within the clayey silt till, the lowest 1.2 meters of the excavation can be excavated near vertical and the remainder of the excavation must be cut back at an angle of 45° from that point.

If necessary for servicing and septic tank installation ("Hub"), excavation into the competent rock can be near vertical, provided all loose material has been removed and there is no potential of rock spalling while the trench is open and workers have access.

For backfilling the exterior of the structure, it is not expected that the existing Granular from the existing graded areas will yield a significant amount of suitable material. Surrounding the "Hub", there may be a potential for harvesting the native silty sand with trace gravel, however, it would be considered suitable only if it is at the optimum moisture content and can be compacted as specified. Alternatively, imported granular (satisfying the OPSS 1010 grading requirements of Granular "B") is expected to be necessary for backfilling the proposed "Hub" building and the proposed campground washrooms, and will be required to be compacted as specified.

The final grades are not known for the proposed parking lot and elliptical roadway on the north side of the "Hub". However, based on the presence of rock, it is suggested that the parking lot be raised sufficiently to allow removal of trees, roots and organics, with minimum rock excavation. Raising the grade will provide better positive subgrade drainage and allow a thicker granular subbase to be constructed. The thicker granular subbase and subgrade will reduce some of the potential for differential frost heave and settlement encountered with a mix of native bedrock and various subgrade soils which will be capped with imported granular fill.

4.2 "Hub" Parking Lot Construction

It is recommended that the proposed parking and elliptical driveway for the "Hub" be constructed as follows:

Table No. 1 – Recommended Pavement Structure

Pavement Component	Access Route/Heavy Duty Pavement Thickness (mm)	Light Duty Pavement Thickness (mm)	Specified Compaction (%)
HL-3 Surface Course	50	60*	92% to 96.0% MRD
HL-4 Base Course	50	-	92% to 96.0% MRD
OPSS Granular 'A'	150	150	100% SPMDD
OPSS Granular 'B' – Type I	300**	300**	100% SPMDD

* To facilitate construction in shoulder seasons, two lifts consisting of 40mm oh HL-3 and 40mm of HL-4 can be considered to replace the one 60mm lift of HL-3 in light duty areas.

** Due to the irregular topography of the rock subgrade within the proposed parking lot, additional Granular may be required below the minimum 300mm to level off the subgrade after stripping the organics and breaking high points of rock.

4.3 "Hub" Septic and Greywater

As noted above, the proposed septic field will be located south of the "Hub" building, with greywater outlet generated from the building being piped to a tile field outlet located between center parking stalls in the landscaped area to the north of the "Hub".

Based on the initial discussions, it is understood that the designed sewage flows will exceed 10,000L/day, which will result in a large septic bed area. It is understood that the play areas and surficial recreational features of the site may be located on top of the proposed septic bed, located south of the proposed "Hub" building.

To assist with the conceptual design of the sewage system, three (3) samples of the overburden below the topsoil were processed in our laboratory for grain size distribution and the determination of the respective percolation rates (T-Times). Results are presented in Appendix 'C' for review by the respective designers. Based on the size of the septic field and the presented elevation/topographic survey data (which identifies various rock outcroppings), it is expected that the septic design will have to be modified accordingly. Due to the varying soil conditions and size of the system, it is to be noted that where the subgrade soils are utilized as part of the design, additional evaluation of the subgrade soils is required across the entire area to confirm the consistency of actual site conditions and design assumptions.

For the location of the proposed greywater outlet, visible rock at surface was encountered across that area. Although the parking area/greywater outlet will likely be in a fill condition due to the construction of the parking lot sub-base, appropriate imported material will be required to be installed to facilitate the proposed greywater discharge into the fill soils.

4.4 Initial Screening – Chemical Testing of Soil

During the site visit, and excavation work, no obvious visual signs of impact were noted at the testhole locations. It should be noted that since there was no evidence of Petroleum Hydrocarbons within the excavations, no PHC or PAH testing was completed.

As per typical submissions to Parks Canada, selected soil samples from various areas of the site were submitted for initial screening and analysis of general metal and inorganics. Maxxam Analytics Inc. (Maxxam) is an accredited laboratory by the Canadian Association for Laboratory Accreditation (CALA) and by the Standards Council of Canada for the analysis requested. Copies of the laboratory Certificate of Analysis are provided in Appendix 'D'.

In addition, three soil samples were sent to determine specific soil parameters with regards to soil corrosivity, conductivity and resistivity. The Certificates of Analysis are also provided in Appendix 'D'.

4.4.1 Chemical Analyses – Environmental Quality

With respect to the metals and inorganics, the reported concentrations for the sample (Hub-TH#5) were below the criteria noted in Table 1 – Background Agricultural or Other (Coarse Grained). For the sample from Hub-TH#1, the concentration of 51 ug/g for Cobalt exceeded the above criteria. Additional samples should be collected for analysis to investigate occurrence of exceedance and potential soil management during construction.

4.4.2 Chemical Analyses – Corrosivity

Five soil samples were submitted for sulphides, soluble chloride, conductivity, pH, and soluble sulphate. CSA A23.1 – 2009 describes the degree of sulphate exposure for concrete as being moderate for soils having sulphate values between 0.10% and 0.20%, severe for values between 0.20% and 2.0%, and very sever for values greater than 2.0%. Based on the reported results of less than 0.020%, neglible impact from the soil to well consolidate concrete would be expected.

The moisture content, sulfide, resistivity and conductivity indicate that the conditions are low to moderately corrosive to underground metallic structures. The reported pH levels are generally near neutral.

5. STATEMENT OF LIMITATIONS

The discussion and recommendations in this report are based upon information gathered at the testhole locations and available geological and physiographical information of general nature for the area. Sub-surface and groundwater conditions are variable and will differ in area beyond the investigated testholes. As a result, conditions may become apparent during further investigation or construction, which would not be detected or anticipated at the time that the site investigation was performed and when this report was prepared. The information in this report is intended for the sole use of Parks Canada and its agents. GM BluePlan Engineering Limited accepts no liability for use of this information by third parties on the basis of information provided in this preliminary are made at the sole risk of the third parties.

The final shape and location of the proposed "Hub" building, parking lot and washroom buildings have not been confirmed and therefore comments made within this report are made in general only to assist the owner and designers for the project in question. Furthermore, the number of testholes may not be sufficient to determine all the factors that may affect the construction methods and costs. For this reason, Contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information presented within this report and then draw their own conclusion on the sub-surface conditions and how it will affect the methods and cost of construction.

It is our recommendation that additional testholes be excavated in the proposed "Hub" development, and more specifically in the septic field to better delineate the rock depth and quantify the required rock excavation where rock depths affect the selected designs. We recommend that we be retained to ensure that all the necessary stripping, sub-grade preparation, and compaction requirements are met, and to be available to confirm that the soil conditions do not deviate from those presented within this report.

All of which is respectfully submitted

GM BLUEPLAN ENGINEERING LIMITED

Per:

Derek Brewster, C.Tech

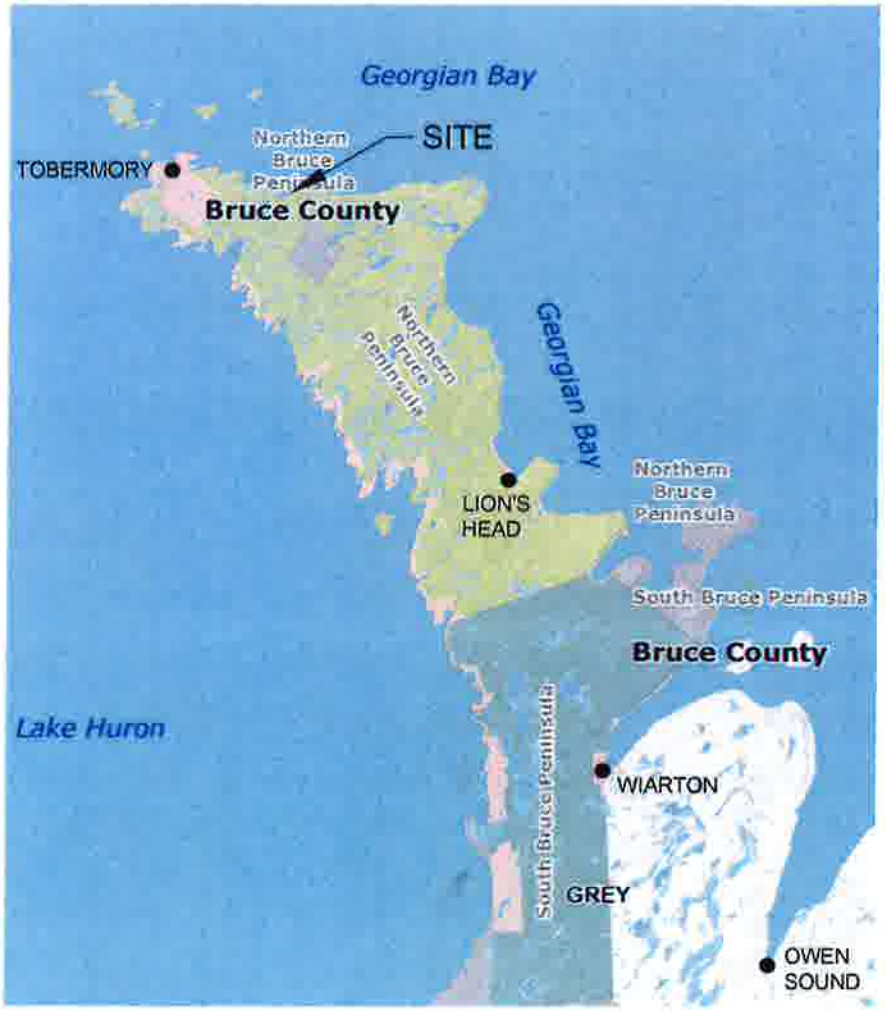
Reviewed by:

Wm. E. Dubeau, P.Eng.

LICENSED PROFESSIONAL ENGINEER
Oct 16/17
W. E. DUBEAU
PROVINCE OF ONTARIO

FIGURES:

217291
Bruce Peninsula
National Park



15 0 10 20 40
1:1000 (m)

SCALE = 1:1,000
SEPTEMBER 2017

SITE LOCATION PLAN

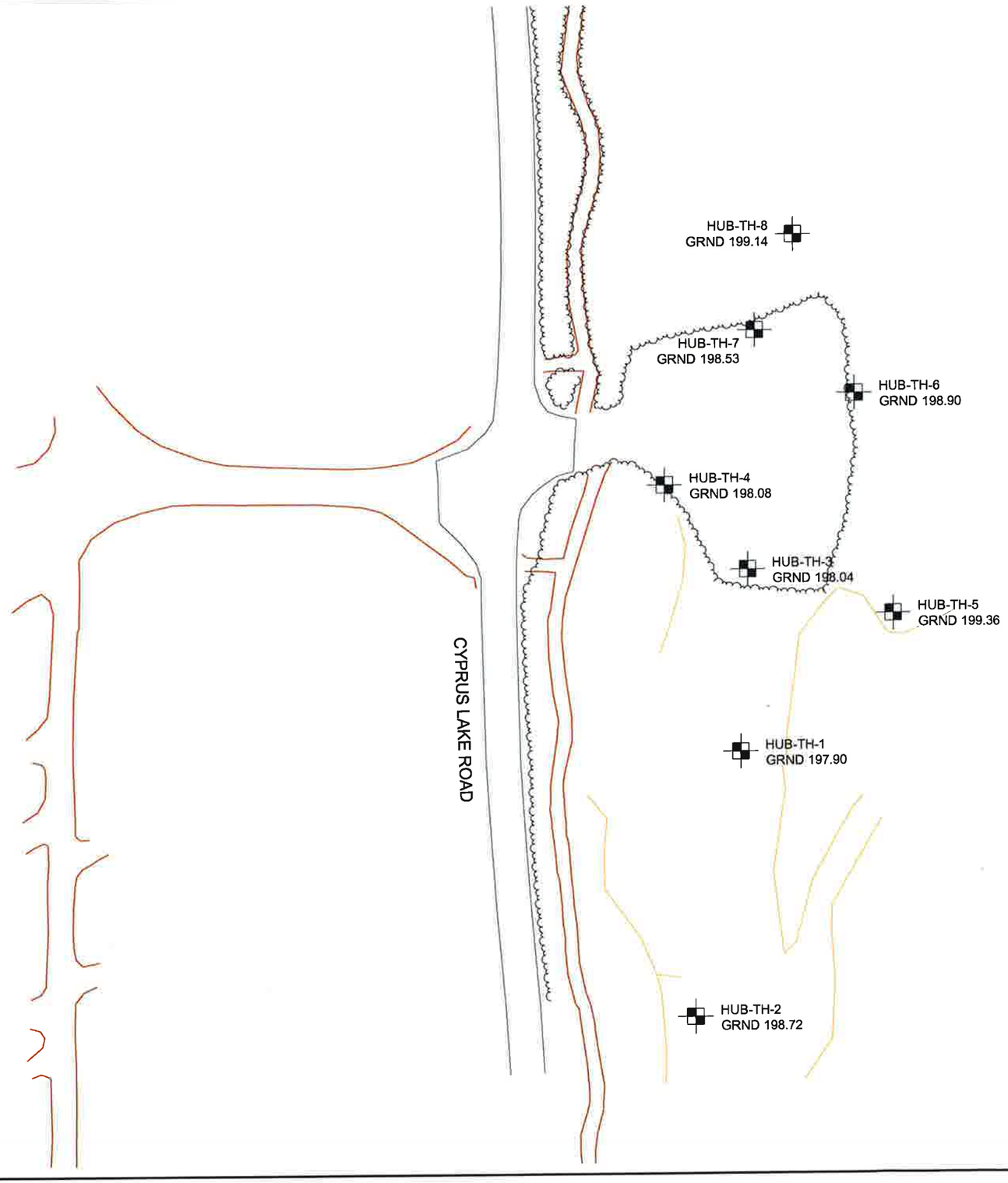
CYPRUS LAKE BIRCHES CAMPGROUND INFRASTRUCTURE IMPROVEMENTS

Figure No. 1

BluePlan ENGINEERING

FILE:C:\Civil 3D Projects\217291 TH Plan-K.dwg LAYOUT:Site Location Plan
LAST SAVED BY:Kboers, 9/11/2017 9:15:24 AM PLOTTED BY:Ken Boers - GM BluePlan 9/11/2017 2:57:37 PM

217291
Bruce Peninsula
National Park



LEGEND

HUB-TH-4
GRND 198.08
TEST HOLE LOCATION, NUMBER AND GROUND ELEVATION

10 5 0 10 20 30
1:750 (m)

SCALE = 1:750
SEPTEMBER 2017

TEST HOLE LOCATION PLAN

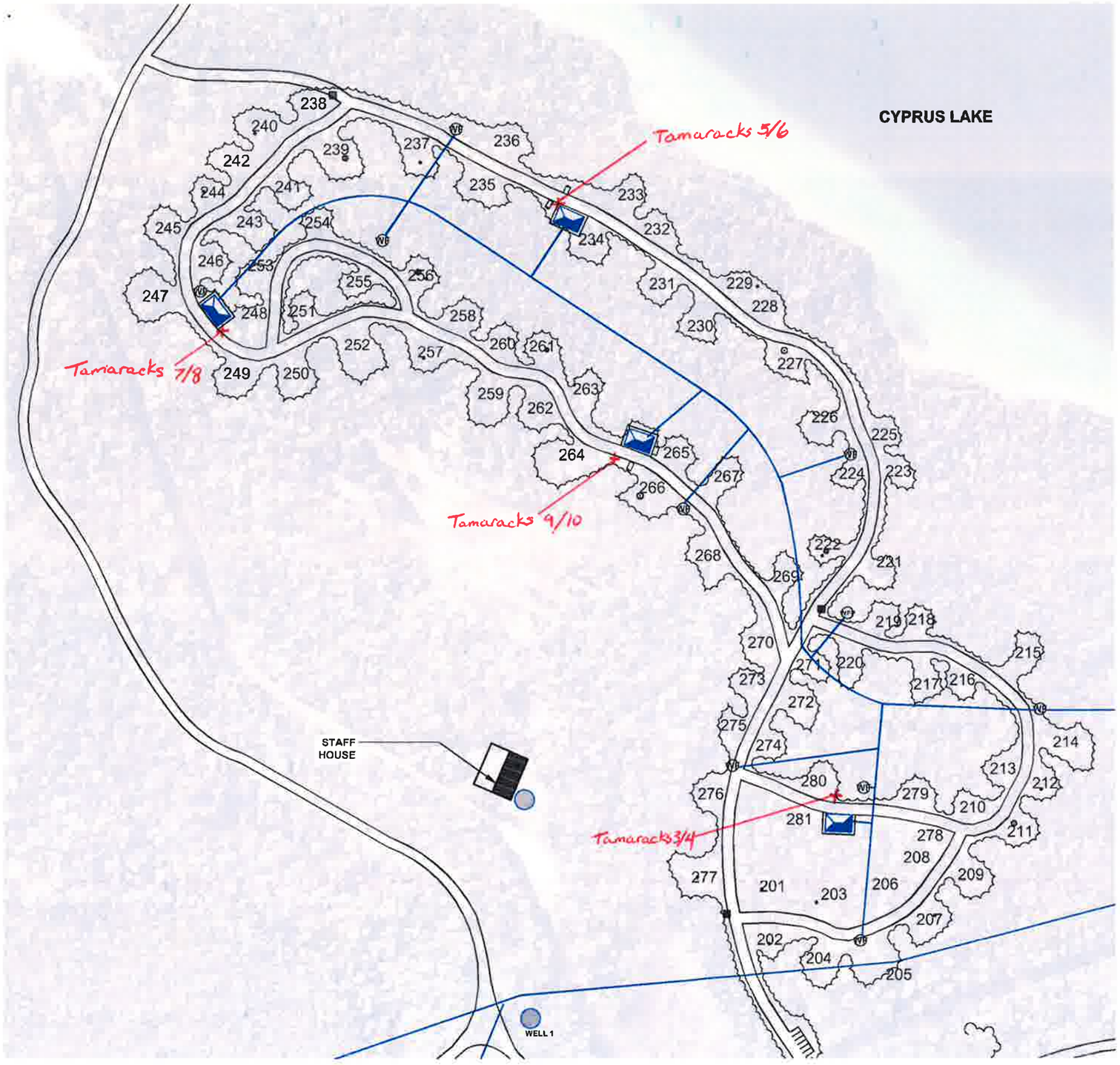
CYPRUS LAKE - "HUB" CAMPGROUND INFRASTRUCTURE IMPROVEMENTS

Figure No. 2

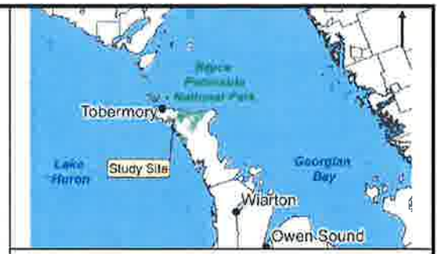
BluePlan ENGINEERING

FILE:C:\Civil 3D Projects\217291 TH Plan-K.dwg LAYOUT:Testhole Plan 2
LAST SAVED BY:Kboers, 9/11/2017 9:15:24 AM PLOTTED BY:Ken Boers - GM BluePlan 9/11/2017 3:00:46 PM

APPENDIX A:
TESTHOLE LOCATION PLANS



Note: Testhole locations are approximate and elevations are assumed as 100.00m at surface; unless otherwise noted



Legend

- PEDESTRIAN TRAIL CONNECTION
- PARKING LAYOUT CONCEPT
- PROPOSED WATER FOUNTAIN
- EXISTING WATER FOUNTAIN
- WATER LINE
- EXISTING GARBAGE DISPOSAL
- EXISTING SURVEYED TREE
- WELL
- NEW WASHROOM BLDG. FOR DETAILS SEE DWG. A-3

Testhole Location Plan

September, 2017

NOTE:
FOR ELECTRICAL INFORMATION REFER TO SERIES 'E' SHEETS

BRUCE PENINSULA NATIONAL PARK
CONSTRUCTION COST BUDGET REPORT

SITE 2 - CYPRUS LAKE
TAMARACKS CAMPGROUND
PROPOSED INFRASTRUCTURE IMPROVEMENTS

September 2016	1:1000	Datum: NAD 83, ZONE 17 Source: Parks Canada, LIO
P#:60438560	V#:	
AECOM		Figure L- 5

CYPRUS LAKE

WELL 2

MAINTAIN TRAIL ACCESS TO CYPRUS LAKE TRAIL AND TAMARACKS CAMPSITES

CAMPSITE LANE CLOSED TO VEHICULAR TRAFFIC

PEDESTRIAN TRAIL CONNECTIONS

SWIMMING CORRAL SEE DWG. L-7

SITE #155

REPLACE EXISTING WASHROOM BUILDINGS WITH ONE COMBINED WASHROOM BUILDING COMPLETE WITH DISHWASHING FACILITY

PEDESTRIAN TRAIL CONNECTIONS

ACTIVITY AREA

Birches 24

Birches 13/14

MAINTAIN TRAIL ACCESS TO POPLARS CAMPSITE

REPLACE EXISTING WASHROOM BUILDINGS WITH ONE COMBINED WASHROOM BUILDING COMPLETE WITH DISHWASHING FACILITY

REPLACE EXISTING WASHROOM BUILDINGS WITH ONE COMBINED WASHROOM BUILDING COMPLETE WITH DISHWASHING FACILITY

CYPRUS LAKE ROAD

BIOFILETER AND MANTEL 4,500 sq.m (50X90m)

Note: Testhole locations are approximate and elevations are assumed as 100.00m at surface, unless otherwise noted.

For "Hub" Testhole Location Plan, refer to Figure No. 2

Legend

- PEDESTRIAN TRAIL CONNECTION
- PARKING LAYOUT CONCEPT
- PROPOSED WATER FOUNTAIN
- EXISTING WATER FOUNTAIN
- WATER LINE
- EXISTING GARBAGE DISPOSAL
- NEW WASHROOM BLDG. FOR DETAILS SEE DWG. A-3

Testhole Location Plan

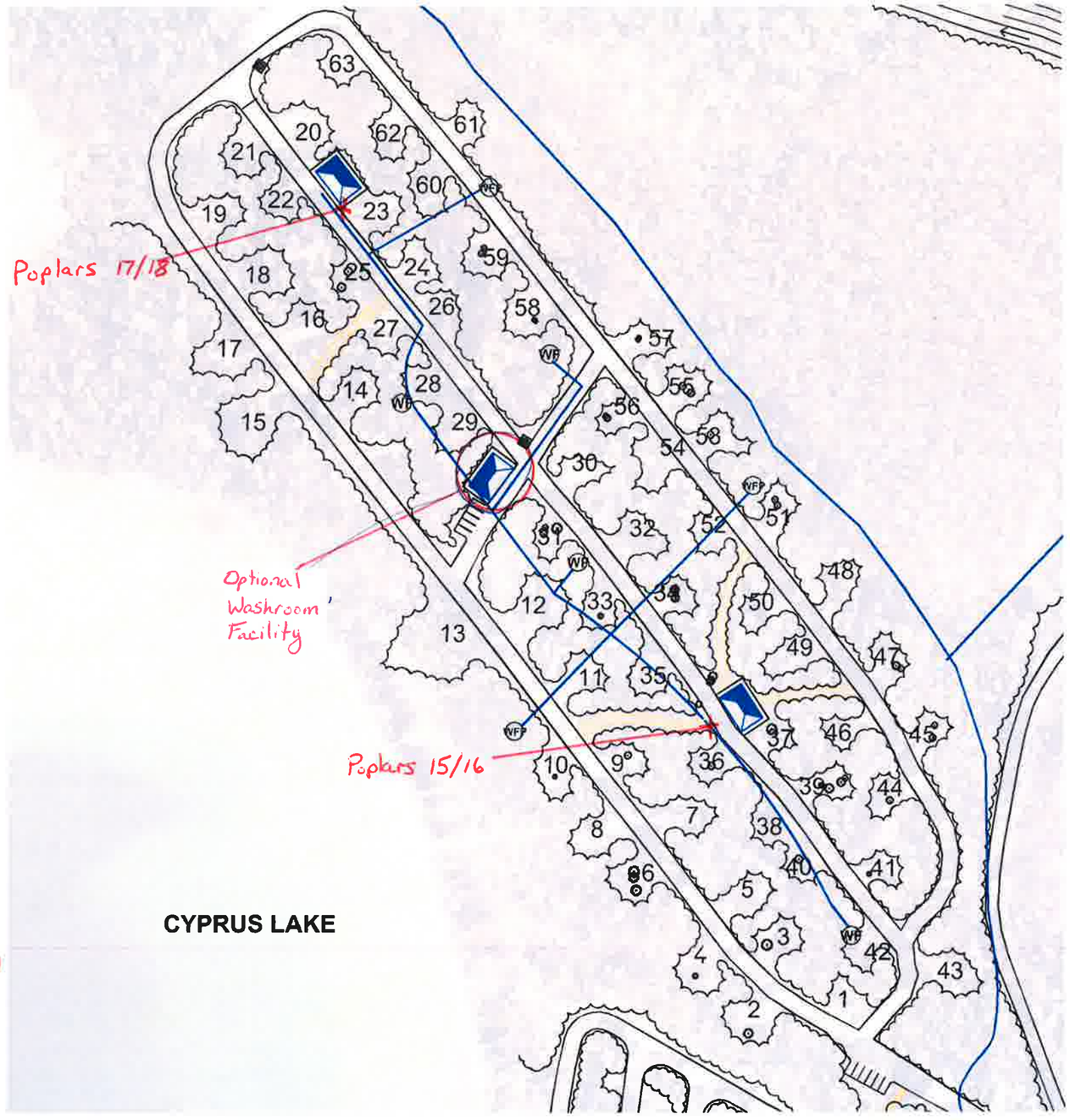
September, 2017

NOTE:
FOR ELECTRICAL INFORMATION REFER TO SERIES 'E' SHEETS

BRUCE PENINSULA NATIONAL PARK
CONSTRUCTION COST BUDGET REPORT

SITE 2 - CYPRUS LAKE
BIRCHES CAMPGROUND
PROPOSED INFRASTRUCTURE IMPROVEMENTS

September 2016	1:750	Datum: NAD 83, ZONE 17 Source: Parks Canada, LIO
P#:60438560	V#:	
AECOM		Figure L-6



Note: Testhole locations are approximate and elevations are assumed as 100.00m at surface, unless otherwise noted.

Legend

- PEDESTRIAN TRAIL CONNECTION
- PARKING LAYOUT CONCEPT
- PROPOSED WATER FOUNTAIN
- EXISTING WATER FOUNTAIN
- WATER LINE
- EXISTING GARBAGE DISPOSAL
- EXISTING SURVEYED TREE
- NEW WASHROOM BLDG. FOR DETAILS SEE DWG. A-3

Testhole Location Plan

September, 2017

NOTE:
FOR ELECTRICAL INFORMATION REFER TO SERIES 'E' SHEETS

BRUCE PENINSULA NATIONAL PARK
CONSTRUCTION COST BUDGET REPORT

SITE 2 - CYPRUS LAKE
POPLARS CAMPGROUND
PROPOSED INFRASTRUCTURE IMPROVEMENTS

September 2016	1:1500	Datum: NAD 83, ZONE 17 Source: Parks Canada, LIO
P#:60438560	V#:	
AECOM		Figure L-8

APPENDIX B:
RECORD OF TESTHOLE LOGS

Log of Testhole: HUB-TH-1

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	197.90		Ground Surface		
	197.75		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
1	197.40		Reddish brown silty sand with trace gravel. Moist and loose to compact.	8.8	
2, 3 / 1	196.80		Brown and grey clayey silt till with sand, gravel and cobbles. Moist and dense to very dense.	8.9	
4	196.70		Weathered limestone bedrock. Moist and hard.		
			Excavation Terminated due to Intact Bedrock Contact.		
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: HUB-TH-2

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 / 0	198.72		Ground Surface		
	198.57		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
1	198.22		Reddish brown silty sand with traces of weathered bedrock (cobble size). Moist and loose to compact.	12.4	
2			Excavation Terminated due to Intact Bedrock Contact.		
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: HUB-TH-3

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	198.04		Ground Surface		
	197.84		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
1	197.64		Reddish brown silty sand with trace gravel. Moist and loose to compact.		
2, 3	197.04		Brown and grey clayey silt till with sand, gravel and cobbles. Moist and dense to very dense.		
1			Excavation Terminated due to Intact Bedrock Contact.		
4, 5, 6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: HUB-TH-4

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	198.08		Ground Surface		
	197.93		Sand and gravel **fill** (19mmØ crushed sand and gravel). Moist and compact.		
	197.78		Sand and gravel **fill** mixed with some organics and tree roots. Moist and compact.		
1	197.58		Weathered limestone bedrock. Moist and hard.		
2			Excavation Terminated due to Intact Bedrock Contact.		
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: HUB-TH-5

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 / 0	199.36		Ground Surface		
	199.16		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
1			Reddish brown silty sand with traces of weathered bedrock (cobble size). Moist and loose to compact.	14.8	
2	198.66		Excavation Terminated due to Intact Bedrock Contact.		
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: HUB-TH-6

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	198.90		Ground Surface		
	198.65		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
1	198.40		Reddish brown silty sand with trace gravel. Moist and loose to compact.		
2	198.00		Brown and grey clayey silt till with sand, gravel and cobbles. Moist and dense to very dense.		
3 / 1			Excavation Terminated due to Intact Bedrock Contact.		
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: HUB-TH-7

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	198.53		Ground Surface		
	198.38		Sand and gravel **fill** (19mmØ crushed sand and gravel). Moist and compact.		
	198.23		Sand and gravel **fill** mixed with some organics and tree roots. Moist and compact.		
1	198.03		Weathered limestone bedrock. Moist and hard.		
2			Excavation Terminated due to Intact Bedrock Contact.		
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: HUB-TH-8

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 ft / 0 m	199.14		Ground Surface		
			Weathered limestone bedrock. Moist and hard.		
	198.94		Excavation Terminated due to Intact Bedrock Contact.		
1 ft					
2 ft					
3 ft / 1 m					
4 ft					
5 ft					
6 ft					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Tamaracks-3/4

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	197.24		Ground Surface		
	197.04		Brown sand and gravel **fill** (19mm Ø crushed sand and gravel). Moist and compact.		
	196.99		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
1			Brown and grey clayey silt till with sand, gravel and cobbles. Moist and dense to very dense.		
2					
3 / 1				8.5	
4					
5	195.54		Excavation Terminated due to boulder or intact Bedrock Contact.		
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Tamaracks-5/6

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 / 0	190.01		Ground Surface		
			Brown sand and gravel **fill** (150mm Ø). Moist and compact.		
	189.71				
1	189.61		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
			Brown silty sand with trace gravel. Moist and loose to compact.		
	189.41				
2			Brown and grey clayey silt till with sand, gravel and cobbles. Moist and dense to very dense.		
3 / 1				8.5	
4					
5	188.31				
6			Excavation Terminated due to boulder or intact Bedrock Contact.		

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Tamaracks-7/8

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	193.73		Ground Surface		
			Brown sand and gravel **fill** mixed with black organics. Moist and loose.		
	193.43		Brown silty sand with trace gravel. Moist and loose to compact.	12.8	
3 / 1	192.73		Excavation Terminated due to intact Bedrock Contact.		

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Tamaracks-9/10

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 / 0	194.94		Ground Surface		
			Brown sand and gravel **fill** (19mm Ø crushed sand and gravel) mixed with weathered bedrock fragments. Moist and compact.		
	194.64				
1			Weathered limestone bedrock. Moist and hard.		
	194.54				
			Excavation Terminated due to intact Bedrock Contact.		
2					
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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people engineering environments
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Log of Testhole: Birches-13/14

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 / 0	193.13		Ground Surface		
	192.98		Sand and gravel **fill** (19mmØ crushed sand and gravel). Moist and compact.		
	192.83		Fine grey sand **fill**. Moist and loose.		
1	192.68		Black topsoil and organics with tree roots. Moist and soft.		
2			Brown silty sand and gravel with cobbles. Moist and compact.		
3 / 1				7.0	
4	191.63				
5			Excavation Terminated due to Boulder or Bedrock Contact.		
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Birches-155

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 / 0	194.98		Ground Surface		
			Sand and gravel **fill** (19mmØ crushed sand and gravel). Moist and compact.		
	194.68		Excavation Terminated due to Intact Bedrock Contact.		
1					
2					
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Birches-24

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	190.88		Ground Surface		
	190.73		Sand and gravel **fill** (19mmØ crushed sand and gravel). Moist and compact.		
			Excavation Terminated due to Intact Bedrock Contact.		
1					
2					
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Poplars-15/16

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 15 25)	Ground Water and Sampling Details
0 / 0	190.82		Ground Surface		
	190.57		Brown sand and gravel **fill** (19mm Ø crushed sand and gravel). Moist and compact.		
1	190.42		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		
	190.22		Weathered limestone bedrock (50mm thick bedding planes). Moist and hard.		
2			Excavation Terminated due to Intact Bedrock Contact.		
3 / 1					
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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Log of Testhole: Poplars-17/18

Project No: 217291

Project: BPNP - Cyprus Lake Campground Upgrades

Client: Parks Canada - via AECOM

Location: Cyprus Lake

Excavation Date: September 4, 2017

Field Technician: D. Brewster, C.Tech

Excavation Company: Munn Excavating Ltd.

SUBSURFACE PROFILE				PROPERTIES	HYDROLOGY
Depth (ft / m)	Elevation	Symbol	Description	% Moisture (5 – 15 – 25)	Ground Water and Sampling Details
0 / 0	188.54		Ground Surface		
	188.39		Brown sand and gravel **fill** (19mm Ø crushed sand and gravel). Moist and compact.		
1	188.14		Brown fine sand **fill**. Moist and loose.		
	188.04		Black topsoil and organics with trace tree roots and gravel. Moist and loose.		Minor groundwater infiltration @ 0.5m bgs.
2	187.64		Reddish brown and grey clayey silt till with sand, gravel and cobbles. Moist and dense to very dense.	13.4	
3 / 1			Excavation Terminated due to Intact Bedrock Contact.		
4					
5					
6					

Notes:

Equipment: JD 27c - Track Mini-I

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APPENDIX C:
GRAIN-SIZE ANALYSIS

GM BluePlan Engineering Limited
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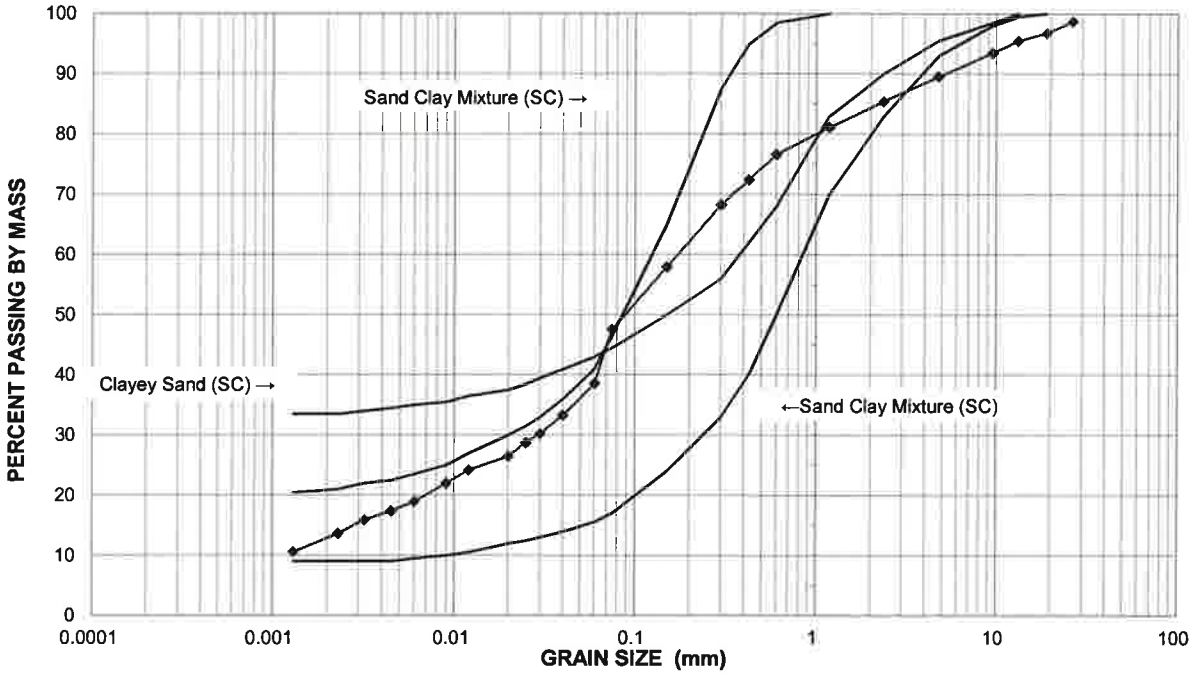
PARTICLE SIZE ANALYSIS

PROJECT:	M.T. - Cyprus Lake Campground Renewal, Tobermory	FILE NO.:	217291
LOCATION:	North Bruce Peninsula	LAB SAMPLE NO.:	S-2651
CLIENT :	AECOM Canada Ltd	SAMPLE DATE:	September 5, 2017
SOIL TYPE:	Clayey Silt Till with Sand, Gravel and Cobbles	SAMPLED BY:	D. Brewster
GRAPH # :	8 - Clayey Sands, Sand-Clay Mixtures	SOURCE:	HUB-TH-1, 1.0 m BG

PARTICLE SIZE DISTRIBUTION



←		FINE	MEDIUM	COARSE	FINE	COARSE
CLAY	SILT	SAND			GRAVEL	

SIEVE SIZE PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE	HYDROMETER PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE
26.5	98.7	0.0600	38.6
19	96.8	0.0400	33.3
13.2	95.5	0.0300	30.3
9.5	93.5	0.0250	28.8
4.75	89.6	0.0200	26.5
2.36	85.5	0.0120	24.2
1.180	81.1	0.0090	22.0
0.600	76.6	0.0060	19.0
0.425	72.5	0.0045	17.4
0.300	68.3	0.0032	15.9
0.150	57.9	0.0023	13.7
0.075	47.6	0.0013	10.6

D_{10} : 0.001 mm **D_{60} :** 0.18 mm **Cu :** 180

Coefficient of Permeability: 1.0 x 10^{-6} cm/sec **"T" Time :** 50 mins/cm

Comments: No cobbles present in collected sample

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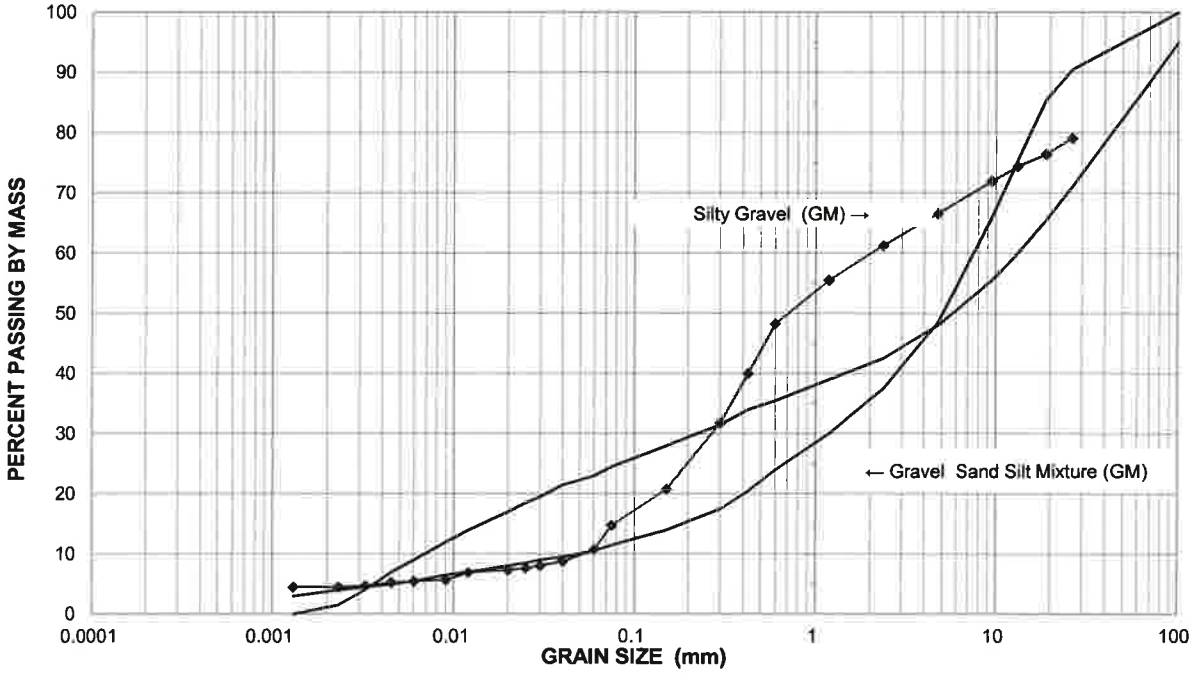
PARTICLE SIZE ANALYSIS

PROJECT:	M.T. - Cyprus Lake Campground Renewal, Tobermory	FILE NO.:	217291
LOCATION:	North Bruce Peninsula	LAB SAMPLE NO.:	S-2652
CLIENT :	AECOM Canada Ltd	SAMPLE DATE:	September 5, 2017
SOIL TYPE:	Silty Sand with trace Gravel	SAMPLED BY:	D. Brewster
GRAPH # :	3 - Silty Gravels, Gravel Sand Silt Mixtures	SOURCE:	HUB-TH-1, 0.4 m BG

PARTICLE SIZE DISTRIBUTION



←		FINE	MEDIUM	COARSE	FINE	COARSE
CLAY	SILT	SAND			GRAVEL	

SIEVE SIZE PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE	HYDROMETER PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE
26.5	79.1	0.0600	10.7
19	76.4	0.0400	8.8
13.2	74.4	0.0300	8.1
9.5	72.0	0.0250	7.6
4.75	66.6	0.0200	7.4
2.36	61.3	0.0120	6.9
1.180	55.5	0.0090	5.7
0.600	48.3	0.0060	5.5
0.425	40.0	0.0045	5.2
0.300	31.8	0.0032	4.8
0.150	20.7	0.0023	4.5
0.075	14.8	0.0013	4.5

D_{10} : 0.05 mm **D_{60} :** 2.1 mm **Cu :** 42

Coefficient of Permeability: 2.5×10^{-3} cm/sec **"T" Time :** 10-15 mins/cm

Comments:

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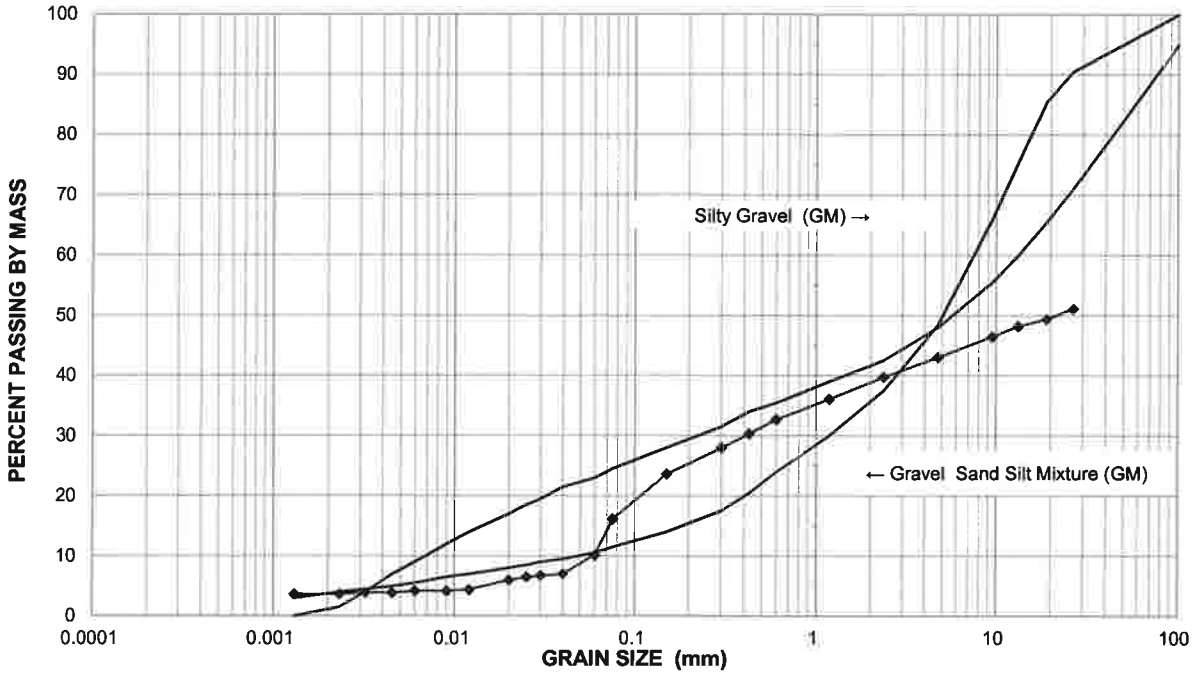
PARTICLE SIZE ANALYSIS

PROJECT:	M.T. - Cyprus Lake Campground Renewal, Tobermory	FILE NO.:	217291
LOCATION:	North Bruce Peninsula	LAB SAMPLE NO.:	S-2653
CLIENT :	AECOM Canada Ltd	SAMPLE DATE:	September 5, 2017
SOIL TYPE:	Silty Sand with trace Gravel	SAMPLED BY:	D. Brewster
GRAPH # :	3 - Silty Gravels, Gravel Sand Silt Mixtures	SOURCE:	HUB-TH-2, 0.3 m BG

PARTICLE SIZE DISTRIBUTION



←		FINE	MEDIUM	COARSE	FINE	COARSE
CLAY	SILT	SAND			GRAVEL	

SIEVE SIZE PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE	HYDROMETER PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE
26.5	51.1	0.0600	10.1
19	49.4	0.0400	7.0
13.2	48.2	0.0300	6.8
9.5	46.4	0.0250	6.5
4.75	43.0	0.0200	6.0
2.36	39.8	0.0120	4.4
1.180	36.1	0.0090	4.2
0.600	32.7	0.0060	4.2
0.425	30.3	0.0045	3.9
0.300	28.0	0.0032	3.9
0.150	23.6	0.0023	3.6
0.075	16.1	0.0013	3.6

D_{10} : 0.06 mm **D_{60} :** 31.1 mm **Cu :** 520

Coefficient of Permeability: 3.6 x 10^{-3} cm/sec **"T" Time :** 10-15 mins/cm

Comments: Cobble sizes bedrock fragments noted in sample

APPENDIX D:
CHEMICAL ANALYSIS RESULTS AND CERTIFICATE OF ANALYSIS

Maxxam
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Your Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT
Your C.O.C. #: 610131-18-01

Attention:Reporting Contacts

GM BluePlan Engineering Limited
1260 - 2nd Ave E
Unit 1
Owen Sound, ON
CANADA N4K 2J3

Report Date: 2017/10/13
Report #: R4777437
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B7J5101
Received: 2017/09/08, 09:22

Sample Matrix: Soil
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride (20:1 extract)	4	N/A	2017/09/12	CAM SOP-00463	EPA 325.2 m
Conductivity	4	N/A	2017/09/12	CAM SOP-00414	OMOE E3530 v1 m
Strong Acid Leachable Metals by ICPMS	2	2017/09/12	2017/09/12	CAM SOP-00447	EPA 6020B m
pH CaCl2 EXTRACT	4	2017/09/11	2017/09/11	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	4	2017/09/08	2017/09/12	CAM SOP-00414	SM 22 2510 m
Sulphate (20:1 Extract)	4	N/A	2017/09/12	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Maxxam
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Your Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT
Your C.O.C. #: 610131-18-01

Attention:Reporting Contacts

GM BluePlan Engineering Limited
1260 - 2nd Ave E
Unit 1
Owen Sound, ON
CANADA N4K 2J3

Report Date: 2017/10/13
Report #: R4777437
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B7J5101
Received: 2017/09/08, 09:22

Encryption Key

Ashton Gibson
Project Manager
13 Oct 2017 14:19:04

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: AGibson@maxxam.ca
Phone# (905) 817-5700

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
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Maxxam Job #: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

SOIL CORROSIVITY PACKAGE (SOIL)

Maxxam ID		FBW141	FBW141	FBW142		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00		
COC Number		610131-18-01	610131-18-01	610131-18-01		
	UNITS	HUB-TH#1 - 1.0M BG	HUB-TH#1 - 1.0M BG Lab-Dup	TAMARAKS 7/8 - 0.6M BG	RDL	QC Batch
Calculated Parameters						
Resistivity	ohm-cm	7600		5700		5155146
Inorganics						
Soluble (20:1) Chloride (Cl)	ug/g	<20		<20	20	5157838
Conductivity	mS/cm	0.132		0.174	0.002	5158423
Available (CaCl2) pH	pH	7.67		7.52		5157265
Soluble (20:1) Sulphate (SO4)	ug/g	<20	<20	<20	20	5157839

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Maxxam ID		FBW143	FBW144	FBW144		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00		
COC Number		610131-18-01	610131-18-01	610131-18-01		
	UNITS	POPLARS 17/18 - 0.6M BG	BIRCHES 13/14 - 0.6M BG	BIRCHES 13/14 - 0.6M BG Lab-Dup	RDL	QC Batch
Calculated Parameters						
Resistivity	ohm-cm	6100	7300			5155146
Inorganics						
Soluble (20:1) Chloride (Cl)	ug/g	<20	<20	<20	20	5157838
Conductivity	mS/cm	0.165	0.136	0.139	0.002	5158423
Available (CaCl2) pH	pH	7.53	7.60			5157265
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20		20	5157839

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Maxxam Job #: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

O.REG 153 ICPMS METALS (SOIL)

Maxxam ID		FBW139	FBW140		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00		
COC Number		610131-18-01	610131-18-01		
	UNITS	HUB-TH#1 - 0.4M BG	HUB-TH#5 - 0.5M BG	RDL	QC Batch
Metals					
Acid Extractable Antimony (Sb)	ug/g	<0.20	<0.20	0.20	5159368
Acid Extractable Arsenic (As)	ug/g	4.5	5.3	1.0	5159368
Acid Extractable Barium (Ba)	ug/g	33	35	0.50	5159368
Acid Extractable Beryllium (Be)	ug/g	0.45	0.54	0.20	5159368
Acid Extractable Boron (B)	ug/g	8.2	7.0	5.0	5159368
Acid Extractable Cadmium (Cd)	ug/g	<0.10	<0.10	0.10	5159368
Acid Extractable Chromium (Cr)	ug/g	30	36	1.0	5159368
Acid Extractable Cobalt (Co)	ug/g	51	9.8	0.10	5159368
Acid Extractable Copper (Cu)	ug/g	30	16	0.50	5159368
Acid Extractable Lead (Pb)	ug/g	9.2	10	1.0	5159368
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	0.53	0.50	5159368
Acid Extractable Nickel (Ni)	ug/g	27	24	0.50	5159368
Acid Extractable Selenium (Se)	ug/g	<0.50	<0.50	0.50	5159368
Acid Extractable Silver (Ag)	ug/g	<0.20	<0.20	0.20	5159368
Acid Extractable Thallium (Tl)	ug/g	0.13	0.14	0.050	5159368
Acid Extractable Uranium (U)	ug/g	0.39	0.40	0.050	5159368
Acid Extractable Vanadium (V)	ug/g	35	37	5.0	5159368
Acid Extractable Zinc (Zn)	ug/g	29	30	5.0	5159368

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

TEST SUMMARY

Maxxam ID: FBW139
Sample ID: HUB-TH#1 - 0.4M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Strong Acid Leachable Metals by ICPMS	ICP/MS	5159368	2017/09/12	2017/09/12	Viviana Canzonieri

Maxxam ID: FBW140
Sample ID: HUB-TH#5 - 0.5M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Strong Acid Leachable Metals by ICPMS	ICP/MS	5159368	2017/09/12	2017/09/12	Viviana Canzonieri

Maxxam ID: FBW141
Sample ID: HUB-TH#1 - 1.0M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	2017/09/12	Alina Dobreanu
Conductivity	AT	5158423	N/A	2017/09/12	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	2017/09/11	2017/09/11	Tahir Anwar
Resistivity of Soil		5155146	2017/09/12	2017/09/12	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5157839	N/A	2017/09/12	Alina Dobreanu

Maxxam ID: FBW141 Dup
Sample ID: HUB-TH#1 - 1.0M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	5157839	N/A	2017/09/12	Alina Dobreanu

Maxxam ID: FBW142
Sample ID: TAMARAKS 7/8 - 0.6M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	2017/09/12	Alina Dobreanu
Conductivity	AT	5158423	N/A	2017/09/12	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	2017/09/11	2017/09/11	Tahir Anwar
Resistivity of Soil		5155146	2017/09/12	2017/09/12	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5157839	N/A	2017/09/12	Alina Dobreanu

Maxxam ID: FBW143
Sample ID: POPLARS 17/18 - 0.6M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	2017/09/12	Alina Dobreanu
Conductivity	AT	5158423	N/A	2017/09/12	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	2017/09/11	2017/09/11	Tahir Anwar

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Maxxam Job #: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

TEST SUMMARY

Maxxam ID: FBW143
Sample ID: POPLARS 17/18 - 0.6M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Resistivity of Soil		5155146	2017/09/12	2017/09/12	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5157839	N/A	2017/09/12	Alina Dobreanu

Maxxam ID: FBW144
Sample ID: BIRCHES 13/14 - 0.6M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	2017/09/12	Alina Dobreanu
Conductivity	AT	5158423	N/A	2017/09/12	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	2017/09/11	2017/09/11	Tahir Anwar
Resistivity of Soil		5155146	2017/09/12	2017/09/12	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5157839	N/A	2017/09/12	Alina Dobreanu

Maxxam ID: FBW144 Dup
Sample ID: BIRCHES 13/14 - 0.6M BG
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	2017/09/12	Alina Dobreanu
Conductivity	AT	5158423	N/A	2017/09/12	Neil Dassanayake

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Maxxam Job #: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

GENERAL COMMENTS

Revised Report[2017/1013]: Sample IDs revised per client request.

Results relate only to the Items tested.

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Maxxam Job #: B7J5101
Report Date: 2017/10/13

QUALITY ASSURANCE REPORT

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5157265	Available (CaCl2) pH	2017/09/11			99	97 - 103			0.11	N/A
5157838	Soluble (20:1) Chloride (Cl)	2017/09/12	108	70 - 130	101	70 - 130	<20	ug/g	NC	35
5157839	Soluble (20:1) Sulphate (SO4)	2017/09/12	112	70 - 130	107	70 - 130	<20	ug/g	NC	35
5158423	Conductivity	2017/09/12			100	90 - 110	<0.002	mS/cm	2.2	10
5159368	Acid Extractable Antimony (Sb)	2017/09/12	99	75 - 125	95	80 - 120	<0.20	ug/g		
5159368	Acid Extractable Arsenic (As)	2017/09/12	99	75 - 125	102	80 - 120	<1.0	ug/g	NC	30
5159368	Acid Extractable Barium (Ba)	2017/09/12	99	75 - 125	93	80 - 120	<0.50	ug/g		
5159368	Acid Extractable Beryllium (Be)	2017/09/12	99	75 - 125	101	80 - 120	<0.20	ug/g		
5159368	Acid Extractable Boron (B)	2017/09/12	95	75 - 125	98	80 - 120	<5.0	ug/g		
5159368	Acid Extractable Cadmium (Cd)	2017/09/12	97	75 - 125	100	80 - 120	<0.10	ug/g	NC	30
5159368	Acid Extractable Chromium (Cr)	2017/09/12	103	75 - 125	105	80 - 120	<1.0	ug/g	2.4	30
5159368	Acid Extractable Cobalt (Co)	2017/09/12	103	75 - 125	103	80 - 120	<0.10	ug/g	12	30
5159368	Acid Extractable Copper (Cu)	2017/09/12	103	75 - 125	103	80 - 120	<0.50	ug/g	1.5	30
5159368	Acid Extractable Lead (Pb)	2017/09/12	102	75 - 125	99	80 - 120	<1.0	ug/g	4.1	30
5159368	Acid Extractable Molybdenum (Mo)	2017/09/12	101	75 - 125	101	80 - 120	<0.50	ug/g		
5159368	Acid Extractable Nickel (Ni)	2017/09/12	103	75 - 125	105	80 - 120	<0.50	ug/g	4.8	30
5159368	Acid Extractable Selenium (Se)	2017/09/12	102	75 - 125	101	80 - 120	<0.50	ug/g		
5159368	Acid Extractable Silver (Ag)	2017/09/12	100	75 - 125	97	80 - 120	<0.20	ug/g		
5159368	Acid Extractable Thallium (Tl)	2017/09/12	100	75 - 125	100	80 - 120	<0.050	ug/g		
5159368	Acid Extractable Uranium (U)	2017/09/12	99	75 - 125	98	80 - 120	<0.050	ug/g		
5159368	Acid Extractable Vanadium (V)	2017/09/12	104	75 - 125	102	80 - 120	<5.0	ug/g		
5159368	Acid Extractable Zinc (Zn)	2017/09/12	102	75 - 125	101	80 - 120	<5.0	ug/g	2.5	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

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Your Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT
Your C.O.C. #: B7J5101-M058-01-01

Attention:Ashton Gibson

MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2017/09/12
Report #: R2442641
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B777528
Received: 2017/09/09, 11:10

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Moisture	4	2017/09/11	2017/09/12	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Sulphide in Soil	4	2017/09/11	2017/09/11	BBY6SOP-00006	SM 22 4500 S2- D m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Your Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT
Your C.O.C. #: B7J5101-M058-01-01

Attention:Ashton Gibson

MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2017/09/12
Report #: R2442641
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B777528
Received: 2017/09/09, 11:10

Encryption Key

Maxxam
12 Sep 2017 14:48:17

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Williamson, Project Manager 1
Email: JWilliamson@maxxam.ca
Phone# (604) 734 7276

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Maxxam Job #: B777528
Report Date: 2017/09/12

MAXXAM ANALYTICS
Client Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		RX9114	RX9115	RX9116		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00		
COC Number		B7J5101-M058-01-01	B7J5101-M058-01-01	B7J5101-M058-01-01		
	UNITS	HUB-TH#1 (FBW141)	TAMARAKS 7/8 (FBW142)	POPLARS 17/18 (FBW143)	RDL	QC Batch
MISCELLANEOUS						
Sulphide	ug/g	0.67	<0.50	0.59	0.50	8754128

RDL = Reportable Detection Limit

Maxxam ID		RX9117	RX9117		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00		
COC Number		B7J5101-M058-01-01	B7J5101-M058-01-01		
	UNITS	BIRCHES 13/14 (FBW144)	BIRCHES 13/14 (FBW144) Lab-Dup	RDL	QC Batch
MISCELLANEOUS					
Sulphide	ug/g	<0.50	0.58	0.50	8754128

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

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Maxxam Job #: B777528
Report Date: 2017/09/12

MAXXAM ANALYTICS
Client Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT

PHYSICAL TESTING (SOIL)

Maxxam ID		RX9114	RX9115	RX9116		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00		
COC Number		B7J5101-M058-01-01	B7J5101-M058-01-01	B7J5101-M058-01-01		
	UNITS	HUB-TH#1 (FBW141)	TAMARAKS 7/8 (FBW142)	POPLARS 17/18 (FBW143)	RDL	QC Batch
Physical Properties						
Moisture	%	8.4	14	12	0.30	8754300
RDL = Reportable Detection Limit						

Maxxam ID		RX9117	RX9117		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00		
COC Number		B7J5101-M058-01-01	B7J5101-M058-01-01		
	UNITS	BIRCHES 13/14 (FBW144)	BIRCHES 13/14 (FBW144) Lab-Dup	RDL	QC Batch
Physical Properties					
Moisture	%	8.4	8.7	0.30	8754300
RDL = Reportable Detection Limit					
Lab-Dup = Laboratory Initiated Duplicate					

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Maxxam Job #: B777528
Report Date: 2017/09/12

MAXXAM ANALYTICS
Client Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT

TEST SUMMARY

Maxxam ID: RX9114
Sample ID: HUB-TH#1 (FBW141)
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL/BAL	8754300	2017/09/11	2017/09/12	Lolita Obusan
Sulphide in Soil	SPEC/COL	8754128	2017/09/11	2017/09/11	Mandheraj Chana

Maxxam ID: RX9115
Sample ID: TAMARAKS 7/8 (FBW142)
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL/BAL	8754300	2017/09/11	2017/09/12	Lolita Obusan
Sulphide in Soil	SPEC/COL	8754128	2017/09/11	2017/09/11	Mandheraj Chana

Maxxam ID: RX9116
Sample ID: POPLARS 17/18 (FBW143)
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL/BAL	8754300	2017/09/11	2017/09/12	Lolita Obusan
Sulphide in Soil	SPEC/COL	8754128	2017/09/11	2017/09/11	Mandheraj Chana

Maxxam ID: RX9117
Sample ID: BIRCHES 13/14 (FBW144)
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL/BAL	8754300	2017/09/11	2017/09/12	Lolita Obusan
Sulphide in Soil	SPEC/COL	8754128	2017/09/11	2017/09/11	Mandheraj Chana

Maxxam ID: RX9117 Dup
Sample ID: BIRCHES 13/14 (FBW144)
Matrix: Soil

Collected: 2017/09/05
Shipped:
Received: 2017/09/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL/BAL	8754300	2017/09/11	2017/09/12	Lolita Obusan
Sulphide in Soil	SPEC/COL	8754128	2017/09/11	2017/09/11	Mandheraj Chana

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Maxxam Job #: B777528
Report Date: 2017/09/12

MAXXAM ANALYTICS
Client Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.0°C

Results relate only to the items tested.

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Maxxam Job #: B777528
Report Date: 2017/09/12

QUALITY ASSURANCE REPORT

MAXXAM ANALYTICS
Client Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8754128	Sulphide	2017/09/11	80 (1)	75 - 125	86	75 - 125	<0.50	ug/g	15 (2)	30
8754300	Moisture	2017/09/12					<0.30	%	3.5 (2)	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

(1) Matrix Spike Parent ID [RX9117-01]

(2) Duplicate Parent ID [RX9117-01]

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Maxxam Job #: B777528
Report Date: 2017/09/12

MAXXAM ANALYTICS
Client Project #: MB7J5101
Site Location: CYPRUS LAKE IMPROVEMENT

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Ph.D., P.Chem., Scientific Specialist

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Your Project #: B7J5101/217291
Site Location: CYPRUS LAKE IMPROVEMENT
Your C.O.C. #: B7J5101-MFOY-01-01

Attention:SUBCONTRACTOR

MAXXAM ANALYTICS INC.
MISSISSAUGA CAMPO
6740 Campobello Rd
MISSISSAUGA, ON
Canada L5N 2L8

Report Date: 2017/09/14
Report #: R2318859
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B755660
Received: 2017/09/12, 10:30

Sample Matrix: SOIL
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Primary Reference
Redox Potential***	4	2017/09/13	2017/09/13	QUE SOP-00151	SM 2580 B

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
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Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

*** This analysis is not subject to MDDELCC accreditation.

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

Your Project #: B7J5101/217291
Site Location: CYPRUS LAKE IMPROVEMENT
Your C.O.C. #: B7J5101-MFOY-01-01

Attention:SUBCONTRACTOR

MAXXAM ANALYTICS INC.
MISSISSAUGA CAMPO
6740 Campobello Rd
MISSISSAUGA, ON
Canada L5N 2L8

Report Date: 2017/09/14
Report #: R2318859
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B755660
Received: 2017/09/12, 10:30

Encryption Key

Diane Goulet
Project Manager Assistant
14 Sep 2017 16:06:25

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Diane Goulet, Project Manager Assistant
Email: DGoulet@maxxam.ca
Phone# (418)658-5784 Ext:6442

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Maxxam Job #: B755660
Report Date: 2017/09/14

MAXXAM ANALYTICS INC.
Client Project #: B7J5101/217291
Site Location: CYPRUS LAKE IMPROVEMENT

CONVENTIONAL PARAMETERS (SOIL)

Maxxam ID		EO1698	EO1699	EO1700	EO1701	
Sampling Date		2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00	
COC Number		B7J5101-MFOY-01-01	B7J5101-MFOY-01-01	B7J5101-MFOY-01-01	B7J5101-MFOY-01-01	
	Units	**FBW141-HUB-TH#1**	**FBW142-TAMARAKS 7/8**	**FBW143-POPLARS 17/18**	**FBW144-BIRCHES 13/14**	**QC Batch**
CONVENTIONALS						
Redox Potential	mV	140	130	130	130	1836707
QC Batch = Quality Control Batch						

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

Maxxam Job #: B755660
Report Date: 2017/09/14

MAXXAM ANALYTICS INC.
Client Project #: B7J5101/217291
Site Location: CYPRUS LAKE IMPROVEMENT

GENERAL COMMENTS

All results are calculated on a dry weight basis except where not applicable.

CONVENTIONAL PARAMETERS (SOIL)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytique 2690, Avenue Dalton, Sainte-Foy, Québec G1P 3S4 Tél.: (418) 658-5784 Télécopieur: (418) 658-6594

Maxxam Job #: B755660
Report Date: 2017/09/14

MAXXAM ANALYTICS INC.
Client Project #: B7J5101/217291
Site Location: CYPRUS LAKE IMPROVEMENT

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
1836707	CB8	Spiked Blank	Redox Potential	2017/09/13		99	%	80 - 120

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

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Maxxam Job #: B755660
Report Date: 2017/09/14

MAXXAM ANALYTICS INC.
Client Project #: B7J5101/217291
Site Location: CYPRUS LAKE IMPROVEMENT

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Provencher, B.Sc., Chemist, Senior Analyst

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CLIENT: GM BluePlan Engineering Limited
PROJECT #: 217291, MAXXAM JOB: B7J5101
INORGANIC PARAMETERS
MATRIX: SOIL

Maxxam Guideline Comparison Tables

2011 Table 1-Background - Agricultural or Other, Coarse Grained

Select Guideline from list above for comparison.

Note: Window zoom values other than 75% may cause unstable performance. ** See Note #5 at bottom of sheet for more information about Guideline Flagging.

Sample ID	Guideline	REPORTING	Units	HUB-TH#1 - 0.4M BG	HUB-TH#5 - 0.5M BG	HUB-TH#1 - 1.0M BG	AMARAKS 7/8 - 0.6M B	OPLARS 17/18 - 0.6M B	IRCHES 13/14 - 0.6M B	HES 13/14 - 0.6M BG D	Matrix Spike	SPIKED BLANK	Method Blank
Laboratory ID / Guideline ID	2011 Table 1-Background	LIMIT		FBW139	FBW140	FBW141	FBW142	FBW143	FBW144	FBW144 DUP 1	99995	99998	99999
Maxxam Job #	Agricultural or Other			B7J5101	B7J5101	B7J5101	B7J5101	B7J5101	B7J5101	B7J5101	B7J5101	B7J5101	B7J5101
Units	ug/g										%	%	
Sampling Date	Coarse Grained			05-September-2017	05-September-2017	05-September-2017	05-September-2017	05-September-2017	05-September-2017	05-September-2017			
Antimony	1	0.2	ug/g	<0.20	<0.20	-	-	-	-	-	99	95	<0.20
Arsenic	11	1	ug/g	4.5	5.3	-	-	-	-	-	99	102	<1.0
Barium	210	0.5	ug/g	33	35	-	-	-	-	-	99	93	<0.50
Beryllium	2.5	0.2	ug/g	0.45	0.54	-	-	-	-	-	99	101	<0.20
Boron (Hot Water Soluble)	NV	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	1	0.1	ug/g	<0.10	<0.10	-	-	-	-	-	97	100	<0.10
Chromium	67	1	ug/g	30	36	-	-	-	-	-	103	105	<1.0
Chromium VI	0.66	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	19	0.1	ug/g	**51**	9.8	-	-	-	-	-	103	103	<0.10
Copper	62	0.5	ug/g	30	16	-	-	-	-	-	103	103	<0.50
Lead	45	1	ug/g	9.2	10	-	-	-	-	-	102	99	<1.0
Mercury	0.16	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	2	0.5	ug/g	<0.50	0.53	-	-	-	-	-	101	101	<0.50
Nickel	37	0.5	ug/g	27	24	-	-	-	-	-	103	105	<0.50
Selenium	1.2	0.5	ug/g	<0.50	<0.50	-	-	-	-	-	102	101	<0.50
Silver	0.5	0.2	ug/g	<0.20	<0.20	-	-	-	-	-	100	97	<0.20
Thallium	1	0.05	ug/g	0.13	0.14	-	-	-	-	-	100	100	<0.050
Vanadium	86	5	ug/g	35	37	-	-	-	-	-	104	102	<5.0
Zinc	290	5	ug/g	29	30	-	-	-	-	-	102	101	<5.0
pH (pH Units)	NV		%	-	-	7.67	7.52	7.53	7.6	-	-	99	-
Conductivity (ms/cm)	0.47	0.002	mS/cm	-	-	0.132	0.174	0.165	0.136	0.139	-	100	<0.002
Sodium Adsorption Ratio	1	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Free	0.051	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	NV	20	ug/g	-	-	<20	<20	<20	<20	<20	108	101	<20
Boron (Total)	36	5	ug/g	8.2	7	-	-	-	-	-	95	98	<5.0
Uranium	1.9	0.05	ug/g	0.39	0.4	-	-	-	-	-	99	98	<0.050

Criteria exceedences will turn BOLD with Yellow Background.
BOLD with Blue Background indicates non-detected but RDL > Guideline criteria (due to dilution etc)

NOTES:

NV = No value

1. Criteria refers to Ministry of Environment "Soil, Ground Water and and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act" March 9, 2004, amended as of July 1, 2011
2. This table represents a summary of the data presented in the Laboratory Certificate of Analysis for convenience purposes only
3. This summary is to be use in conjuction with, not as a replacement of the Laboratory Ceriticate of Analysis which contains all QA/QC information
4. New parameters indicated in the July 1, 2011 amendment, will appear at the bottom of each criteria page.
5. Guideline flagging accuracy only guaranteed when result units correspond with guideline units on spreadsheet.

Maxxam Job Number: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

SOIL CORROSIVITY PACKAGE (SOIL)

Maxxam ID		FBW141	FBW141	FBW142	FBW143	FBW144	FBW144		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00	2017/09/05 14:00		
COC Number		610131-18-01	610131-18-01	610131-18-01	610131-18-01	610131-18-01	610131-18-01		
	UNITS	**HUB-TH#1 - 1.0M BG**	**HUB-TH#1 - 1.0M BG Lab-Dup**	**TAMARAKS 7/8 - 0.6M BG**	**POPLARS 17/18 - 0.6M BG**	**BIRCHES 13/14 - 0.6M BG**	**BIRCHES 13/14 - 0.6M BG Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Resistivity	ohm-cm	7600		5700	6100	7300			5155146
Inorganics									
Soluble (20:1) Chloride (Cl)	ug/g	<20		<20	<20	<20	<20	20	5157838
Conductivity	mS/cm	0.132		0.174	0.165	0.136	0.139	0.002	5158423
Available (CaCl2) pH	pH	7.67		7.52	7.53	7.60			5157265
Soluble (20:1) Sulphate (SO4)	ug/g	<20	<20	<20	<20	20		20	5157839

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Results relate only to the items tested.

Results relate only to the items tested.

Maxxam Job Number: B7J5101
Report Date: 2017/10/13

GM BluePlan Engineering Limited
Client Project #: 217291
Site Location: CYPRUS LAKE IMPROVEMENT

O.REG 153 ICPMS METALS (SOIL)

Maxxam ID		FBW139	FBW140		
Sampling Date		2017/09/05 14:00	2017/09/05 14:00		
COC Number		610131-18-01	610131-18-01		
	UNITS	**HUB-TH#1 - 0.4M BG**	**HUB-TH#5 - 0.5M BG**	**RDL**	**QC Batch**
Metals					
Acid Extractable Antimony (Sb)	ug/g	<0.20	<0.20	0.20	5159368
Acid Extractable Arsenic (As)	ug/g	4.5	5.3	1.0	5159368
Acid Extractable Barium (Ba)	ug/g	33	35	0.50	5159368
Acid Extractable Beryllium (Be)	ug/g	0.45	0.54	0.20	5159368
Acid Extractable Boron (B)	ug/g	8.2	7.0	5.0	5159368
Acid Extractable Cadmium (Cd)	ug/g	<0.10	<0.10	0.10	5159368
Acid Extractable Chromium (Cr)	ug/g	30	36	1.0	5159368
Acid Extractable Cobalt (Co)	ug/g	51	9.8	0.10	5159368
Acid Extractable Copper (Cu)	ug/g	30	16	0.50	5159368
Acid Extractable Lead (Pb)	ug/g	9.2	10	1.0	5159368
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	0.53	0.50	5159368
Acid Extractable Nickel (Ni)	ug/g	27	24	0.50	5159368
Acid Extractable Selenium (Se)	ug/g	<0.50	<0.50	0.50	5159368
Acid Extractable Silver (Ag)	ug/g	<0.20	<0.20	0.20	5159368
Acid Extractable Thallium (Tl)	ug/g	0.13	0.14	0.050	5159368
Acid Extractable Uranium (U)	ug/g	0.39	0.40	0.050	5159368
Acid Extractable Vanadium (V)	ug/g	35	37	5.0	5159368
Acid Extractable Zinc (Zn)	ug/g	29	30	5.0	5159368

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Results relate only to the items tested.

GM BluePlan Engineering Limited

Maxxam Job Number: B7J5101

Client Project #: 217291

Report Date: 2017/10/13

Site Location: CYPRUS LAKE IMPROVEMENT

TEST SUMMARY

Maxxam ID	FBW139		**Collected**	9/5/2017	
Sample ID	HUB-TH#1 - 0.4M BG		**Shipped**		
Matrix	Soil		Received	2017/09/08	

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Strong Acid Leachable	ICP/MS	5159368	9/12/2017	9/12/2017	Viviana Canzonieri

Maxxam ID	FBW140		**Collected**	9/5/2017	
Sample ID	HUB-TH#5 - 0.5M BG		**Shipped**		
Matrix	Soil		Received	2017/09/08	

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Strong Acid Leachable	ICP/MS	5159368	9/12/2017	9/12/2017	Viviana Canzonieri

Maxxam ID	FBW141		**Collected**	9/5/2017	
Sample ID	HUB-TH#1 - 1.0M BG		**Shipped**		
Matrix	Soil		Received	2017/09/08	

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	9/12/2017	Alina Dobreanu
Conductivity	AT	5158423	N/A	9/12/2017	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	9/11/2017	9/11/2017	Tahir Anwar
Resistivity of Soil		5155146	9/12/2017	9/12/2017	Automated Statchk
Sulphate (20:1 Extract	KONE/EC	5157839	N/A	9/12/2017	Alina Dobreanu

Maxxam ID	FBW141 Dup		**Collected**	9/5/2017	
Sample ID	HUB-TH#1 - 1.0M BG		**Shipped**		
Matrix	Soil		Received	2017/09/08	

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract	KONE/EC	5157839	N/A	9/12/2017	Alina Dobreanu

Maxxam ID	FBW142		**Collected**	9/5/2017	
Sample ID	TAMARAKS 7/8 - 0.6M BG		**Shipped**		
Matrix	Soil		Received	2017/09/08	

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	9/12/2017	Alina Dobreanu
Conductivity	AT	5158423	N/A	9/12/2017	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	9/11/2017	9/11/2017	Tahir Anwar
Resistivity of Soil		5155146	9/12/2017	9/12/2017	Automated Statchk

Sulphate (20:1 Extract	KONE/EC	5157839	N/A	9/12/2017	Alina Dobreanu

Maxxam ID	FBW143		**Collected**	9/5/2017
Sample ID	POPLARS 17/18 - 0.6M BG		**Shipped**	
Matrix	Soil		Received	2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	9/12/2017	Alina Dobreanu
Conductivity	AT	5158423	N/A	9/12/2017	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	9/11/2017	9/11/2017	Tahir Anwar
Resistivity of Soil		5155146	9/12/2017	9/12/2017	Automated Statchk
Sulphate (20:1 Extract	KONE/EC	5157839	N/A	9/12/2017	Alina Dobreanu

Maxxam ID	FBW144		**Collected**	9/5/2017
Sample ID	BIRCHES 13/14 - 0.6M BG		**Shipped**	
Matrix	Soil		Received	2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	9/12/2017	Alina Dobreanu
Conductivity	AT	5158423	N/A	9/12/2017	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5157265	9/11/2017	9/11/2017	Tahir Anwar
Resistivity of Soil		5155146	9/12/2017	9/12/2017	Automated Statchk
Sulphate (20:1 Extract	KONE/EC	5157839	N/A	9/12/2017	Alina Dobreanu

Maxxam ID	FBW144 Dup		**Collected**	9/5/2017
Sample ID	BIRCHES 13/14 - 0.6M BG		**Shipped**	
Matrix	Soil		Received	2017/09/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5157838	N/A	9/12/2017	Alina Dobreanu
Conductivity	AT	5158423	N/A	9/12/2017	Neil Dassanayake

Report Date: 2017/10/13

GM BluePlan Engineering Limited
Attention: Reporting Contacts
Client Project #: 217291

Site Location: CYPRUS LAKE IMPROVEMENT

Quality Assurance Report
Maxxam Job Number: B7J5101

QA/QC Bat	Init	QC Type	Parameter	Date Analy	Value	Recovery	UNITS	QC Limits
5157265	TA1	Spiked Blank	Available (CaCl2) pH	9/11/2017		99	%	97 - 103
5157265	TA1	RPD	Available (CaCl2) pH	9/11/2017	0.11		%	N/A
5157838	ADB	Matrix Spike [FBW144-01]	Soluble (20:1) Chloride (Cl)	9/12/2017		108	%	70 - 130
5157838	ADB	Spiked Blank	Soluble (20:1) Chloride (Cl)	9/12/2017		101	%	70 - 130
5157838	ADB	Method Blank	Soluble (20:1) Chloride (Cl)	9/12/2017	<20		ug/g	
5157838	ADB	RPD [FBW144-01]	Soluble (20:1) Chloride (Cl)	9/12/2017	NC		%	35
5157839	ADB	Matrix Spike [FBW141-01]	Soluble (20:1) Sulphate (SO4)	9/12/2017		112	%	70 - 130
5157839	ADB	Spiked Blank	Soluble (20:1) Sulphate (SO4)	9/12/2017		107	%	70 - 130
5157839	ADB	Method Blank	Soluble (20:1) Sulphate (SO4)	9/12/2017	<20		ug/g	
5157839	ADB	RPD [FBW141-01]	Soluble (20:1) Sulphate (SO4)	9/12/2017	NC		%	35
5158423	NYS	Spiked Blank	Conductivity	9/12/2017		100	%	90 - 110
5158423	NYS	Method Blank	Conductivity	9/12/2017	<0.002		mS/cm	
5158423	NYS	RPD [FBW144-01]	Conductivity	9/12/2017	2.2		%	10
5159368	VIV	Matrix Spike	Acid Extractable Antimony (Sb)	9/12/2017		99	%	75 - 125
			Acid Extractable Arsenic (As)	9/12/2017		99	%	75 - 125
			Acid Extractable Barium (Ba)	9/12/2017		99	%	75 - 125
			Acid Extractable Beryllium (Be)	9/12/2017		99	%	75 - 125
			Acid Extractable Boron (B)	9/12/2017		95	%	75 - 125
			Acid Extractable Cadmium (Cd)	9/12/2017		97	%	75 - 125
			Acid Extractable Chromium (Cr)	9/12/2017		103	%	75 - 125
			Acid Extractable Cobalt (Co)	9/12/2017		103	%	75 - 125
			Acid Extractable Copper (Cu)	9/12/2017		103	%	75 - 125
			Acid Extractable Lead (Pb)	9/12/2017		102	%	75 - 125
			Acid Extractable Molybdenum (Mo)	9/12/2017		101	%	75 - 125
			Acid Extractable Nickel (Ni)	9/12/2017		103	%	75 - 125
			Acid Extractable Selenium (Se)	9/12/2017		102	%	75 - 125
			Acid Extractable Silver (Ag)	9/12/2017		100	%	75 - 125
			Acid Extractable Thallium (Tl)	9/12/2017		100	%	75 - 125
			Acid Extractable Uranium (U)	9/12/2017		99	%	75 - 125
			Acid Extractable Vanadium (V)	9/12/2017		104	%	75 - 125
			Acid Extractable Zinc (Zn)	9/12/2017		102	%	75 - 125
5159368	VIV	Spiked Blank	Acid Extractable Antimony (Sb)	9/12/2017		95	%	80 - 120
			Acid Extractable Arsenic (As)	9/12/2017		102	%	80 - 120
			Acid Extractable Barium (Ba)	9/12/2017		93	%	80 - 120
			Acid Extractable Beryllium (Be)	9/12/2017		101	%	80 - 120
			Acid Extractable Boron (B)	9/12/2017		98	%	80 - 120
			Acid Extractable Cadmium (Cd)	9/12/2017		100	%	80 - 120
			Acid Extractable Chromium (Cr)	9/12/2017		105	%	80 - 120
			Acid Extractable Cobalt (Co)	9/12/2017		103	%	80 - 120
			Acid Extractable Copper (Cu)	9/12/2017		103	%	80 - 120
			Acid Extractable Lead (Pb)	9/12/2017		99	%	80 - 120
			Acid Extractable Molybdenum (Mo)	9/12/2017		101	%	80 - 120
			Acid Extractable Nickel (Ni)	9/12/2017		105	%	80 - 120
			Acid Extractable Selenium (Se)	9/12/2017		101	%	80 - 120
			Acid Extractable Silver (Ag)	9/12/2017		97	%	80 - 120
			Acid Extractable Thallium (Tl)	9/12/2017		100	%	80 - 120
			Acid Extractable Uranium (U)	9/12/2017		98	%	80 - 120
			Acid Extractable Vanadium (V)	9/12/2017		102	%	80 - 120
			Acid Extractable Zinc (Zn)	9/12/2017		101	%	80 - 120
5159368	VIV	Method Blank	Acid Extractable Antimony (Sb)	9/12/2017	<0.20		ug/g	
			Acid Extractable Arsenic (As)	9/12/2017	<1.0		ug/g	
			Acid Extractable Barium (Ba)	9/12/2017	<0.50		ug/g	
			Acid Extractable Beryllium (Be)	9/12/2017	<0.20		ug/g	
			Acid Extractable Boron (B)	9/12/2017	<5.0		ug/g	
			Acid Extractable Cadmium (Cd)	9/12/2017	<0.10		ug/g	
			Acid Extractable Chromium (Cr)	9/12/2017	<1.0		ug/g	
			Acid Extractable Cobalt (Co)	9/12/2017	<0.10		ug/g	
			Acid Extractable Copper (Cu)	9/12/2017	<0.50		ug/g	
			Acid Extractable Lead (Pb)	9/12/2017	<1.0		ug/g	
			Acid Extractable Molybdenum (Mo)	9/12/2017	<0.50		ug/g	
			Acid Extractable Nickel (Ni)	9/12/2017	<0.50		ug/g	
			Acid Extractable Selenium (Se)	9/12/2017	<0.50		ug/g	
			Acid Extractable Silver (Ag)	9/12/2017	<0.20		ug/g	
			Acid Extractable Thallium (Tl)	9/12/2017	<0.050		ug/g	
			Acid Extractable Uranium (U)	9/12/2017	<0.050		ug/g	
			Acid Extractable Vanadium (V)	9/12/2017	<5.0		ug/g	
			Acid Extractable Zinc (Zn)	9/12/2017	<5.0		ug/g	
5159368	VIV	RPD	Acid Extractable Arsenic (As)	9/12/2017	NC		%	30
			Acid Extractable Cadmium (Cd)	9/12/2017	NC		%	30
			Acid Extractable Chromium (Cr)	9/12/2017	2.4		%	30
			Acid Extractable Cobalt (Co)	9/12/2017	12		%	30
			Acid Extractable Copper (Cu)	9/12/2017	1.5		%	30
			Acid Extractable Lead (Pb)	9/12/2017	4.1		%	30
			Acid Extractable Nickel (Ni)	9/12/2017	4.8		%	30
			Acid Extractable Zinc (Zn)	9/12/2017	2.5		%	30

N/A = Not Applicable
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

AECOM Imagine it. Delivered.

Appendix C

Schedule of Values

AECOM

Project # 60554371
Date: June 19, 2018

Cyprus Lake Campground - The Hub Amenity Building
Bruce Peninsula National Park, Tobermory Ontario

Cyprus Lake Campground - The Hub Amenity Building

Schedule of Values

Description	Total Cost Per Division
Division 1 General Requirements & Fees	
Division 3 Concrete	
Division 4 Masonry	
Division 5 Metals	
Division 6 Wood, Plastics and Composites	
Division 7 Thermal & Moisture Protection	
Division 8 Doors & Windows	
Division 9 Finishes	
Division 10 Specialties	
Division 21 Fire Suppression	
Division 22 Plumbing	
Division 23 Heating, Ventilation & Air Conditioning	
Division 26 Electrical	
Division 27 Communications	
Division 28 Electronic Safety and Security	
Division 31 Earthwork	
Division 32 Exterior Improvements	
Division 33 Utilities	
Division 34 Transportation	
Contingency	
Total Cost	**$ -**