



Government of Canada | Gouvernement du Canada

DEPARTMENT OF NATIONAL DEFENCE
REAL PROPERTY OPERATIONS DETACHMENT (BORDEN)
CANADIAN FORCES BASE BORDEN

SPECIFICATION
Issued for Tender

**THIS DOCUMENT CONTAINS A SECURITY REQUIREMENT / CE
DOCUMENT CONTIENT DES EXIGENCES RELATIVES À LA SÉCURITÉ**

Solving Contamination Deficiencies

In Building A-243
17 HANGAR ROAD, BORDEN, ONTARIO

PROJECT OFFICER:

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JOB NO: L-B147-9618/12

P.F. NO: BN186586

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201	Typical Details	2023-02-24
202	Typical & Project Details	2023-09-20
203	Floor Plan	2022-10-18
204	Mezzanine Plan	2023-07-26
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206	Building Sections	2023-07-26
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312	Door Schedule, Door & Frame Elevations & Jamb Details	2017-05-29
400	Legends, Drawing List and Code Synopsis	2017-05-29
410	Ground Floor Plan Fire Protection - Demolition	2017-05-29
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420	Ground Floor Plan Plumbing - Demolition	2017-05-29
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Part 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 The work to be completed under this contract includes but it's not limited to the demolition of existing conditions to allow for reconfiguration the space, relocation of existing washrooms and change rooms, installation of new air showers and paint booth, reconfiguration of electrical and mechanical systems to suit new layout, update fire suppression system and update fire alarm system under the scope of work.
- .2 Removal and reinstatement of existing moveable furniture and equipment will be performed by forces as directed by DND and to be coordinated by DCC Representative with Contractor.

1.3 LOCATION OF THE SITE

- .1 CFB Borden is located on County Road 90, 23 km. West of Barrie, Ontario.

1.4 SITE ACCESS

- .1 Upon entering the Base, the Contractor has voluntarily consented to a search of his vehicle and its contents while on any part of CFB Borden and said military establishments, by the Base Commander or person designated by him.
- .2 The purpose of any search conducted is to ensure the security of CFB Borden and said military establishments, and/or material or classified information belonging to the Canadian Armed Forces.

1.5 CONTRACTOR TRAFFIC ROUTE

- .1 All contract related commercial motor vehicles must use the south entrance (known as the South Gate or Alliston Gate) to enter and exit CFB Borden. Furthermore, these vehicles must use Ortona Road and then the shortest distance between Ortona Road and the intended destination to navigate around the Base. This requirement extends to all subcontractors and delivery vehicles.
- .2 Commercial motor vehicles are defined as any heavy equipment, tractor trailers, cement trucks, dump trucks, cranes, any vehicle towing a trailer, and delivery type trucks larger than cube vans.
- .3 Exemptions: Roadways leading to CFB Borden can be impeded due to construction, maintenance, weather or seasonal / maximum weight restriction bans. It is also understood that some suppliers or delivery vehicles will service the Base as part of a larger area or

regional route thus cannot be expected to absorb additional time or costs. Should such conditions exist, CFB Borden, for said occurrences or in accordance with provincial advisories, Road Restrictions and Seasonal Road Bans may allow commercial vehicle traffic to enter or exit via the north entrance (known as the North Gate or Angus Gate).

- .4 Enforcement of commercial motor vehicle traffic and routes once inside CFB Borden falls to the Military Police who hold the same authorities as civilian police as well as enhanced search & seizure powers related to all military or civilian activities on Department of National Defense property.

1.6 CONTRACTOR USE OF PREMISES

- .1 Coordinate use of premises under direction of DCC Representative.
- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .3 Work shall be performed from 7:00 to 17:00 hours daily Monday to Friday and excluding all federal holidays. Submit schedule for work to be reviewed by DCC Representative.
- .4 Project site shall remain unoccupied during the duration entire construction period.
- .5 As part of the coordination between occupant and handover of the building to the contractor, the contractor shall prepare and submit a Fire Safety Plan. The plan shall be based on the DND Template to be provided by DCC. The plan will further define the phases of the work, the timing of the phases, communication planning with occupants and also will include drawings depicting emergency exit plans for each phase of the work.
 - .1 Refer to Section 01 70 12, Safety Requirements for further details.

1.7 REFERENCES AND CODES

- .1 National Building Code of Canada (NBC), National Plumbing Code of Canada (NPC), National Energy Code of Canada (NECB), Canadian Electrical Code (CEC) and National Fire Code of Canada (NFC) including all amendments up to tender closing date.
- .2 The design of the facility shall comply with all comply with DND standards including:
 - .1 Canadian Forces Fire Marshall Directive FMD 4003 – Fire Protection and Life Safety Engineering Design Guide.
 - .2 Construction Engineering Technical Orders (CETO) C-05-040-005/TS-001 – Paint Refinishing Facility
 - .3 Request copies of DND standards from DCC Representatives.
- .3 The design of the facility shall comply with all applicable Acts, Regulations, Bylaws, policies and standards associated with the Infrastructure and Environment for the project. In the event of a conflict, the most stringent of the applicable standard shall apply, unless directed otherwise by DCC Representative.
- .4 Meet or exceed requirements of:

- .1 Contract documents.
- .2 Specified standards, codes and referenced documents.

1.8 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: Demolition of spray or trowel-applied asbestos can be hazardous to health. Should material resembling spray or trowel-applied asbestos be encountered in course of demolition work, immediately stop work and notify DCC Representative.
- .2 If any substances encountered are suspected to be Designated Substances, make the area safe and contact the DCC Representative immediately on how to proceed.
- .3 Third party hazardous materials inventory report is included as an appendix to this document.

1.9 BUILDING SMOKING ENVIRONMENT

- .1 Smoking is prohibited in all work places within DND 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.

1.10 RELICS AND ANTIQUITIES

- .1 Protect relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during course of work.
- .2 Give immediate notice to DCC Representative and await DCC Representative's written instructions before proceeding with work in this area.
- .3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory are specified under various sections. Contractor and DCC Representative will each engage their own testing & inspection company for the purpose of this contract.

1.2 APPOINTMENT AND PAYMENT

- .1 DCC Representative will appoint and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Assurance (QA) testing, except follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .3 Mill tests and certificates of compliance.
 - .4 Tests specified to be carried out by Contractor under the supervision of DCC Representative.
 - .5 Additional tests specified in the following paragraph.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by DCC Representative to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

- .1 The contractor to furnish and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Control (QC) testing in accordance with the contractor's quality control plan.
- .2 Provide labour, equipment and facilities to:
 - .1 Provide access to Work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
- .3 Notify DCC Representative sufficiently in advance of testing & inspection operations (24hrs minimum).
- .4 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .5 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed.

END OF SECTION

Part 1 General

1.1 PROJECT MEETINGS

- .1 DCC Representative will arrange project meetings and assume responsibility for setting times and recording and distributing 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 Manufacturers' installation and application instructions.

1.3 SCHEDULES

- .1 Contractor to submit a construction progress schedule to DCC 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 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 DCC Representative.

1.4 CLOSEOUT PROCEDURES

- .1 Notify DCC Representative when Work is considered ready for Substantial Performance.
- .2 Accompany DCC Representative on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with DCC Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to occupied areas.
- .4 Notify DCC Representative of instructions for completion of items of Work determined in DCC Representative's final inspection.

1.5 COST BREAKDOWN

- .1 Contractor to submit a detailed cost breakdown to DCC Representative at least ten (10) working days prior to the submission of the first progress claim. After approval by DCC Representative the cost breakdown will be used as basis for progress payment.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of DCC Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to DCC Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants affected parties not in attendance and DCC Representative.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 DCC Representative, Contractor, major Subcontractors, and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 31 19.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security in accordance with Section 01 56 00.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Record drawings in accordance with Section 01 33 00.
 - .9 Maintenance manuals in accordance with Section 01 78 00.

- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and biweekly.
- .2 Contractor, major Subcontractors involved in Work DCC Representative are to be in attendance.
- .3 Notify parties minimum 5 days before progress meetings to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Shop drawings and product data.
- .2 Samples.

1.2 ADMINISTRATIVE

- .1 Submit to DCC Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not 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 DCC Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
- .6 Notify DCC 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 DCC Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by DCC Representative 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 articles 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 days for DCC 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 DCC Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as DCC Representative may require, consistent with Contract Documents. When resubmitting, notify DCC Representative in writing of any revisions other than those requested.
- .6 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.
- .7 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.
- .8 After DCC Representative's review, distribute copies.

- .9 Submit electronic copies of shop drawings for each requirement requested in specification Sections.
- .10 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by DCC Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 If upon review by DCC 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.
- .14 The review of shop drawings by the DCC Representative is for sole purpose of ascertaining conformance with general concept. This review shall not mean that the DCC Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

1.4 SAMPLES

- .1 Submit for review samples in as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Notify DCC 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 DCC Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to DCC Representative prior to proceeding with Work.
- .5 Make changes in samples which DCC 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 **Precedence** - Division 1 sections take precedence over technical specifications in other Divisions of this project manual.

1.2 REFERENCES

- .1 Definitions:
 - .1 Contract Security Program (CSP) - A division of Public Services and Procurement Canada (PSPC), which developed the Contract Security Manual and helps industry to participate in Government of Canada and foreign government contracts. CSP provides security screening services needed for contractors before their employees can work with Protected and Classified information and assets.
 - .2 Company Security Officer (CSO) - The CSO is the organization's official point of contact with the CSP. The CSO is responsible for monitoring the organization's security profile, addressing security issues, and is accountable to the CSP and to the organization's designated Key Senior Official on all industrial security matters.
 - .3 Contractor CSO - The employee of the Contractor's company who is the CSO.
 - .4 Contract Security Manual (CSM) - The CSM is a ready and simple reference which tells Company Security Officers what they must know about Canadian government security standards and procedures and how to ensure that their organization meets these security requirements.
 - .5 Positive Control - Measures which guarantee that persons without appropriate clearance will not be left unattended to access the Department of National Defence/Canadian Armed Forces (DND/CAF) information, assets, resources, or locations.
 - .6 Request for Visit (RFV) - A form to be filled out by an individual who requires access to sensitive DND property, personnel, information, assets and resources because they must be security screened at the appropriate level before commencement of their duties.
 - .7 Restricted - Refers to a situation where authorized persons only, are allowed access to an area or information.
 - .8 Security Implementation Plan - A detailed document which outlines the company's strategy and process to meet contract security requirements.
 - .9 Security Requirements Check List (SRCL) - The SRCL is a Treasury Board Secretariat (TBS) form used to define the security requirements for a contract. The SRCL represents an evaluation of security threats and risks that may arise through the contracting process.
 - .10 Sensitive - Records that are sensitive contain information that can cause different degrees of injury to an individual, a company, or the country if the information were disclosed in an unauthorized manner.
- .2 Reference Sites:

- .1 Defence Construction Canada (DCC)
 - .1 <https://www.dcc-cdc.gc.ca/industry/security-requirements>
- .2 PSPC Contract Security Manual
 - .1 <https://www.tpsgc-pwgsc.gc.ca/esc-src/msc-csm/index-eng.html>

1.3 GENERAL

- .1 Security requirements must form part of the contract between DCC and industry when defined by a SRCL.
- .2 These security requirements apply but are not limited to:
 - .1 construction and material objects;
 - .2 contractual arrangements;
 - .3 professional service contracts;
 - .4 facility maintenance contracts; and
 - .5 environmental and UXO contracts.
- .3 A SRCL is a form that is used to define the security requirements associated with each contract. The SRCL ensures that the appropriate security clauses are identified so they may be incorporated into the contract, thereby legally binding the parties to meet the contract's security requirements. **The SRCL must accompany all contract documents including subcontracts that contain security requirements.**
- .4 If multiple levels of screening are required, a Security Classification Guide may have been provided along with the SRCL as a contractual document. This document will provide further information related to security requirements when dealing with multiple levels of clearances within the contract.

1.4 PRIVATE SECTOR ORGANIZATION SCREENING AND CLEARANCES

- .1 Companies who will need access to or who will retain controlled goods, protected or classified property, information, assets or resources must be cleared as follows:
 - .1 Companies must be cleared to safeguard the highest level of information and asset to be retained/accessed, meaning:
 - .1 Designated Organization Screening (DOS) is required for contracts involving access to information at the protected level and/or secure worksites (Reliability status);
 - .2 Facility Security Clearance (FSC) is required for contracts involving access to information at the protected and/or classified levels and/or secure worksites (Secret status);
 - .3 Document Safeguarding Capability (DSC) is required to work on protected and/or classified information at their own worksite; and
 - .4 Companies who will electronically process protected or classified information must have IT media clearance and processing capability commensurate with the security classification level of the information to be processed and must be cleared to the level commensurate with the information or asset to be accessed.

1.5 PERSONNEL SECURITY SCREENING

- .1 Individuals requiring access to information and/or site must have their personnel security screening completed prior to submitting an RFV. As a part of the screening process, it is now a requirement for individuals to undergo a law enforcement inquiry through the RCMP, for electronic finger printing. Please refer to PSPC website for more information.
- .2 Prior to Contract Award, personnel security screenings may not be initiated due to CSP requirements. Therefore, contractors must allow time in their schedules to seek personnel security screenings as required by the contract.
 - .1 Reliability status processing is anticipated to take seven (7) business days per employee after a request has been properly submitted to CSP; and
 - .2 Secret clearance processing is anticipated to take seventy-five (75) business days per employee after a request has been properly submitted to CSP.

1.6 VISIT CLEARANCE REQUESTS (VCR) APPROVAL

- .1 All individuals (including subcontractors) who will have access to sensitive DND or CAF property, personnel, information, assets, and resources, must be security screened at the appropriate level before the commencement of their duties in relation to the contract.
- .2 Access to Operations Zones: security screening is not required for certain personnel if positive control of those individuals is maintained throughout their visit. Positive control measures must be outlined in the Security Implementation Plan. Positive control can be used for the following personnel:
 - .1 Logistics activities – material drop-off, waste removal, snow removal;
 - .2 Transit through an operations zone (no work); and
 - .3 Authorities having jurisdiction.
- .3 The VCR process verifies that those who are permitted access onto DND property have the required clearance level as outlined within the SRCL for the contract.

1.7 POST AWARD PROCESS OVERVIEW

- .1 The Contractor's CSO is provided a blank RFV form by the DCC Representative in order to obtain an approved VCR.
- .2 All employees of the successful bidder who will be accessing restricted sites or sensitive information during the execution of the contract require a VCR. The Contractor's CSO must forward the completed form to the DCC Representative for processing.
 - .1 The CSO of each company completing an RFV form must submit a picklist from the Online Industrial Security Services (OLISS) portal instead of filling in the details of each visitor on the form. Only the employees of the company who require access to the restricted site or sensitive information for that contract shall be listed on the picklist.
 - .2 If the Contractor intends to use Union Hall members, the CSO will request the Union Hall to provide the CSO with a separate picklist for all members to be used on the contract. Only the individuals of the Union Hall who require access to the site for that contract shall be listed on the picklist.

- .3 The CSO of the company will input “SEE ATTACHED PICKLIST” when completing Particulars of Visitors.
- .3 It is the responsibility of the Prime Contractor to submit and receive an approved SRCL for each subcontract containing security requirements. This responsibility extends to all subcontracts held by subcontractors.
 - .1 Instructions on this process are in the CSM located at <https://www.tpsgc-pwgsc.gc.ca/esc-src/msc-csm/index-eng.html>
 - .2 Prior to Contract Award, subcontract SRCL security screenings may not be initiated due to CSP requirements. Therefore, contractors must allow time in their schedules for subcontract SRCL approvals as required by the contract.
 - .1 When a Private Sector Organization Screening (PSOS) is **not** required, contractors shall allow 45 business days (from the date on which a complete and correct subcontract SRCL is received by CSP) for approval of a subcontract SRCL by CSP.
 - .2 When a PSOS **is** required:
 - .1 For sub-contractors to be sponsored to the level of DOS, contractors shall allow for 50 business days (from the date on which a complete and correct PSOS is submitted to CSP) for approval of a subcontract SRCL by CSP; and
 - .2 For sub-contractors to be sponsored to the level of FSC (Secret), contractors shall allow 124 business days (from the date on which a complete and correct PSOS is submitted to CSP) for approval of a subcontract SRCL by CSP.
 - .3 All security related pre-construction activities shall proceed immediately after award.
- .4 For subcontracts, the RFV shall not be submitted until after the subcontract SRCL has been approved and permission to award the contract is granted by CSP.
 - .1 Contractor to allow a minimum of 15 business days for VCR processing.
- .5 Personnel not meeting the required security clearances will not be allowed access to restricted sites or any sensitive information pertaining to the contract, except as permitted in 1.6.2.
- .6 Approved VCRs are valid for the duration of the contract **or** one year less one day, whichever is less. Extension to VCRs will need to be requested as required, again allowing a minimum of 15 business days for processing.

1.8 SUBMITTALS

- .1 Submit to the DCC Representative copies of the following documents, including updates issued:
 - .1 Security Implementation Plan
 - .2 Approved subcontract SRCLs
 - .3 Completed Request for Visit forms for all personnel working under the contract
 - .4 Incident reports within (1) working day

- .5 Submit other data, information and documentation upon request by the DCC Representative.

1.9 RESPONSIBILITY

- .1 It is the responsibility of the Contractor to have no security breaches while undertaking the work for this contract.

1.10 MEETINGS

- .1 Prior to commencement of work, the Contractor will attend a pre-commencement meeting conducted by the DCC Representative. Ensure, as minimum, attendance by Contractor's site superintendent.
 - .1 The DCC Representative will advise of time, date and location of the meeting and will be responsible for recording and distributing the minutes.
 - .2 If requested by the DCC Representative, the Contractor's CSO will be required to participate in the pre-commencement meeting.
- .2 Conduct site specific security meetings as required to ensure the management of security is in accordance with the contract.
 - .1 Record and post minutes of all meetings as allowed by the security requirements of the contract.

1.11 SECURITY IMPLEMENTATION PLAN

- .1 Contractors are required to have in place a contract specific Security Implementation Plan that addresses the security requirements outlined in the contract.
- .2 Provide one copy of the Security Implementation Plan to the DCC Representative prior to the commencement of work.
- .3 At a minimum, the plan shall contain details addressing:
 - .1 CSO name and contact information;
 - .2 Schedule for subcontract SRCLs and RFVs;
 - .3 Site Access and Control Monitoring including verification that all people entering secure areas on site have approved VCRs in accordance with contractual security requirements, or any planned positive control measures;
 - .4 Security Education (i.e. Restrictions on photographs); and
 - .5 Security Incident Reporting.
- .4 The DCC Representative will coordinate review of the Security Implementation Plan by the DND Project Security Authority to be completed within 10 business days of receipt following which the DCC Representative shall confirm DND's acceptance or rejection with comments.

1.12 INCIDENT REPORTING

- .1 Investigate and report any security incidents immediately to the DCC Representative.
 - .1 Immediately provide a copy of the incident/investigation reports to the DCC Representative.

- .2 Refer to Chapter 5 of the CSM <https://www.tpsgc-pwgsc.gc.ca/esc-src/msc-csm/index-eng.html> for more information.
- .2 For the purpose of this contract, immediately notify the DCC Representative of incidents that involve a security breach from the identified clauses on the SRCL or an interruption to adjacent and/or integral infrastructure operations with potential loss implications.
- .3 In the investigation and reporting of incidents, the Contractor is required to respond in a timely fashion (within 5 working days) to correct the action that was deemed to have caused the incident and advise in writing on the action taken to prevent a re-occurrence of the incident.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 CONSTRUCTION FIRE SAFETY

- .1 The Contractor shall provide construction fire safety in accordance with the National Fire Code of Canada.

1.2 RELATED SECTIONS

- .1 Section 01 35 43 Environmental Procedures
- .2 Section 01 70 12 Safety Requirements
- .3 Section 02 81 01 Hazardous Materials

1.3 REFERENCES

- .1 Occupational Health and Safety Act (OHSA)
 - .1 Ontario Regulation 632/05- Confined Spaces
- .2 Government of Canada
 - .1 Canada Labour Code, Part II - Canada Occupational Health and Safety Regulations (COHSR), SOR/86-304, Part XI- Confined Spaces
 - .2 National Fire Code of Canada (NFC)

1.4 FIRE DEPARTMENT BRIEFING

- .1 DCC Representative will co-ordinate arrangements for Pre-Commencement Meeting following contract award. Contractors will be briefed on Fire Safety by the Base Fire Department before work starts.

1.5 REPORTING FIRES

- .1 The Contractor shall inform the DCC representative and Base Fire Department of all fire incidents at the construction site, regardless of size.
- .2 Know location of nearest fire alarm pull station and telephone, including emergency phone number.
- .3 Report immediately fire incidents to Base Fire Department as follows:
 - .1 Activate nearest fire alarm pull station.
 - .2 Telephone 911, Inform dispatcher of location at CFB Borden
- .4 Person activating fire alarm pull station will remain at the front entrance to direct Base Fire Department to scene of fire.
- .5 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify location.

1.6 FIRE SAFETY PLAN

- .1 Submit a fire safety plan for the construction site prior to commencement of construction work. The fire safety plan shall conform to the National Fire Code of Canada and Base Fire Department guidelines.

- .2 The fire safety plan shall be submitted to the DCC representative for review by Base Fire Department. Any comments by Base Fire Department shall be implemented by the Contractor.
- .3 The fire safety plan shall be limited to the area of construction only. Contractor is not responsible for amending fire safety plans in existing buildings.
- .4 Post the fire safety plan at the entrance to the construction site or near the construction site's health and safety board.
- .5 The fire safety plan shall conform to the National Fire Code of Canada, and shall contain, at minimum:
 - .1 Emergency procedures to be used in case of fire, including
 - .1 Sounding the fire alarm;
 - .2 Notifying the fire department;
 - .3 Instructing occupants on procedures to be followed when the fire alarm sounds;
 - .4 Evacuating occupants, including special provisions for persons requiring assistance; and
 - .5 Confining, controlling and extinguishing fires.
 - .2 The appointment and organization of designated supervisory staff to carry out fire safety duties.
 - .3 The training of responsibilities for supervisory staff and other occupants.
 - .4 Documents including diagrams, showing the type, location and operation of building fire emergency systems.
 - .5 The holding of fire drills (where applicable).
 - .6 The control of fire hazards in the building.
 - .7 The inspection and maintenance of building facilities provided for the safety of occupants.

1.7 FIRE WARNING SYSTEM

- .1 A fire warning shall be provided to notify construction personnel of a fire emergency in the construction area.
- .2 The system used shall be capable of being heard throughout the building.

1.8 INTERIOR AND EXTERIOR FIRE PROTECTION AND ALARM SYSTEMS

- .1 Fire protection and alarm system will not be:
 - .1 Obstructed.
 - .2 Shut-off.
 - .3 Left inactive at end of working day or shift without prior written authorization from the Base Fire Department.
- .2 Do not use Fire hydrants, standpipes or hose systems for other than fire-fighting purposes unless authorized by the Base Fire Department.

1.9 FIRE PROTECTION SYSTEM IMPAIRMENT

- .1 Notify the DCC Representative by completing a Fire Alarm Impairment Permit 48 hours (for coordination with Base Fire Department and RP Ops Det Fire alarm techs) prior to shutting down any active fire protection system, including water supply, fire suppression, fire detection and life safety systems.
- .2 Where a fire protection system that provides fire alarm monitoring is impaired in an existing building, a fire watch may be required at the discretion of the Base Fire Department.
- .3 Implement all fire protection system impairments in accordance with the National Fire Code of Canada and Base Fire Orders. Fire Orders will be provided at the Pre-Commencement Meeting.

1.10 FIRE EXTINGUISHERS

- .1 In addition to other requirements of this specification, supply fire extinguishers, as scaled by the Base Fire Department, necessary to protect work in progress and contractor's physical plant on site.
- .2 Fire extinguishers may be required in the following areas as directed by the Base Fire Department
 - .1 Adjacent to hot works;
 - .2 In areas where combustibles are stored;
 - .3 Near or on any internal combustion engines;
 - .4 Adjacent to areas where flammable liquids or gases are stored or handled;
 - .5 Adjacent to temporary oil fired or gas fired equipment; and
 - .6 Adjacent to bitumen heating equipment.
- .3 Extinguishers shall be sized as 4-A: 40-B: C (20 lbs) unless otherwise directed by the Base Fire Department.
- .4 Extinguishers shall be of the dry chemical type unless otherwise required by the hazard being protected.
- .5 The Contractor may assume the quantity of extinguishers based on a maximum travel distance between extinguishers of 75 feet.

1.11 ACCESS FOR FIRE FIGHTING

- .1 Access for firefighting shall be provided in accordance with the National Fire Code of Canada.
- .2 Advise the DCC Representative of work that would impede fire apparatus response. This includes violation of minimum horizontal and overhead clearance, as prescribed by the Base Fire Department, erecting of barricades and digging of trenches.
- .3 Minimum horizontal clearance: clear width of not less than 5m, or as defined by the Base Fire Department.
- .4 Minimum vertical clearance: overhead height of not less than 6m, or as defined by the Base Fire Department.

1.12 SMOKING PRECAUTIONS

- .1 Smoking is prohibited in all buildings. Observe posted smoking restrictions near existing buildings.

1.13 RUBBISH AND WASTE MATERIALS

- .1 Keep rubbish and waste materials at minimum quantities.
- .2 Burning of rubbish is prohibited.
- .3 Remove rubbish from work site at end of work day or shift or as directed.
- .4 Storage:
 - .1 Storage of oily waste shall be 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 specified.

1.14 FLAMMABLE AND COMBUSTIBLE LIQUIDS

- .1 Handle, store and use of flammable and combustible liquids in accordance with the National Fire Code of Canada.
- .2 Keep flammable and combustible liquids such as gasoline, kerosene and naphtha 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. Obtain written authorization from DCC Representative for storage of quantities of flammable and combustible liquids exceeding 45 litres.
- .3 Do not transfer flammable or combustible liquids inside buildings or on jetties.
- .4 Do not transfer flammable or combustible liquids in vicinity of open flames or any type of heat-producing devices.
- .5 Do not use flammable liquids having flash point below 38 degrees C such as naphtha or gasoline as solvents or cleaning agents.
- .6 Store flammable and combustible waste liquids, for disposal, in approved containers located in safe ventilated area. Keep quantities to a minimum and notify DCC Representative when disposal is required.
- .7 Use secondary containment vessels for all transfer of flammable or combustible materials.
- .8 Report all spills to DCC Representative.

1.15 HOT WORKS

- .1 The Contractor shall implement a hot works program in accordance with the National Fire Code of Canada and NFPA 51 Standard for Fire Prevention during Welding, Cutting and Other Hot Work.
- .2 The Contractor shall obtain from the Base Fire Department a "Hot Work" permit for all hot works in the construction area. Frequency of renewal for hot works permits is at the discretion of the Base Fire Department.
- .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 Base Fire Department.

- .4 Provide fire watch service for work on scale as defined in the Fire Department Briefing. Fire watchers shall be trained in the use of fire extinguishing equipment.

- .5 Area of hot works

- .1 Hot works shall be carried out in an area free of combustible and flammable content.

- .2 Where 1.16.5.1 is not possible,

- .1 All flammable and combustible materials within 15m of the hot works shall be protected in accordance with the National Fire Code of Canada;

- .2 A fire watch shall be provided during the hot work and for a period of not less than 60 minutes unless otherwise directed by the Base Fire Department;

- .3 A final inspection of the hot work area shall be conducted not less than 4 hours after the completion of hot works unless otherwise directed by the Base Fire Department.

- .3 Where there is a possibility of sparks leaking onto combustible materials in areas adjacent to the areas where the hot work is carried out.

- .1 Openings in walls, floors or ceilings shall be covered or closed to prevent the passage of sparks to such adjacent areas, or

- .2 Sentence 1.16.5.2 shall apply for those areas.

- .6 Protection of flammable and combustible materials

- .1 Any combustible or flammable material, dust or residue shall be:

- .1 Removed from the area where hot works is carried out; or

- .2 Protected from ignition by non-combustible materials.

- .7 Fire extinguisher

- .1 A fire extinguisher shall be provided within 3 m of all hot works. Minimum size shall be 20lbs ABC unless otherwise directed by Base Fire Department.

1.16 CONFINED SPACE

- .1 The Contractor shall implement a confined space program in accordance with the latest versions of COHSR or OSHA, whichever is more stringent.

- .2 The Base Fire Department monitors all confined space occurrences and must be notified prior to entrance and after exit.

1.17 HAZARDOUS SUBSTANCES

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

- .2 Provide ventilation where flammable liquids, such as lacquers or urethanes are used. Eliminate all sources of ignition. Inform the Base Fire Department prior to and at completion of such works.

1.18 PARTIAL OCCUPANCY

- .1 Implement partial occupancy procedures as defined in the drawings and specifications. Partial occupancy is where construction occurs adjacent to work areas occupied by Departmental or Canadian Forces personnel. This includes:
 - .1 Phased new construction.
 - .2 Early or partial occupancy of new construction.
 - .3 New construction being added onto an existing building.
 - .4 Renovation or recapitalization of an existing building.
 - .5 Phased renovation or recapitalization of an existing building.
- .2 Where partial occupancy occurs, Contractor shall implement requirements as found in the drawings and specifications. This may include construction of a rated fire separation between occupied and construction areas as required by the National Fire Code.
- .3 A watch, with tours at intervals of not less than one hour, shall be provided throughout demolition sites when there are occupants in the portion of the building not being demolished.
- .4 Except where a building is provided with a fire alarm system or similar equipment, a watch, with tours at intervals of not more than one hour, shall be provided when a portion of the building is occupied while construction operations are taking place.

1.19 QUESTIONS AND/OR CLARIFICATION

- .1 All questions or requests for clarification on Fire Safety in addition to above requirements shall be directed to the DCC Representative.
- .2 DCC is responsible to obtain clarifications from the Base Fire Department. The Contractor is not to liaise directly with the Base Fire Department for notification, authorization, other than Hot Work Permits, or any requests unless the situation constitutes an immediate emergency.

1.20 FIRE INSPECTION

- .1 All site inspections by the Base Fire Department shall be coordinated through the DCC Representative.
- .2 Allow the Base Fire Department unrestricted access to work site.
- .3 Co-operate with the Base Fire Department during routine fire safety inspection of work site.
- .4 Immediately remedy unsafe fire situations observed by the Base Fire Department.

END OF SECTION

Part 1 General

1.1 REFERENCES FEDERAL

- .1 Applicable Base/Wing Environmental Administrative Instructions (AI) or Base Standing Orders (BSOs) will be provided to the Contractor after award.
 - .1 Directorate Contaminated Sites (DCS) Contaminated Sites Instruction (CSI.004.001)- Imported Fill. 15 June 2020.
 - .2 DCS CSI (CSI.004.001) - Soil Management. V. 2.0, 20 Jan 2021.
- .2 Canadian Council of Ministers of the Environment (CCME). *Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Aquatic Life, Total Particulate Matter*, 2002.
- .3 Canadian Council of Ministers of the Environment. (CCME). *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products*. PN 1326. 2003.
- .4 *Canadian Environmental Protection Act 1999*. Statutes of Canada 1999 Chapter 33.
 - .1 Federal Halocarbon Regulations, 2022. SOR/2022-110.
 - .2 PCB Regulations. SOR/2008-273.
 - .3 Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations. SOR/2008-197.
- .5 *Canada Labour Code- Canadian Occupational Health and Safety Regulations* (SOR/86-304). 2019.
- .6 *Canada Occupational Health and Safety Regulations* (SOR/86-304). Canada Labour Code.
- .7 *Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems* (the Environment and Climate Change Canada “Refrigeration Code of Practice”). April 2015, Errata 2021.
- .8 *Code of Practice for the Environmental Sound Management of End-of-Life Lamps Containing Mercury*. Environment and Climate Change Canada. 2017.
- .9 *Fisheries Act*. Revised Statutes of Canada 1985, Chapter F-14.
- .10 *Migratory Birds Convention Act, 1994*.
- .11 *Navigation Protection Act*. Revised Statutes of Canada 1985, Chapter N-22.
- .12 *Species at Risk Act*, 2003. Chapter 25-29, no.3.

- .13 *Transportation of Dangerous Goods Act* and pursuant regulations.

PROVINCIAL

- .14 *Ontario Water Resources Act*. Revised Statutes of Ontario 1990, Chapter O.40.
- .15 *Technical Standards and Safety Act, 2000* and pursuant regulations, codes, and standards. Statutes of Ontario 2000, Chapter 16.
- .16 *Environmental Protection Act*. Revised Statutes of Ontario 1990, Chapter E.19.
- .1 Ontario Regulation 102/94. *Waste Audits and Waste Reduction Work Plans*.
- .2 Ontario Regulation 103/94. *Industrial, Commercial, and Institutional Source Separation Programs*.
- .3 Ontario Regulation 153/04. *Records of Site Condition*. Part XV.1 of the Act.
- .4 Ontario Regulation 347. *General—Waste Management*. Revised Regulations of Ontario 1990
- .5 Ontario Regulation 362. *Waste Management – PCB's*.
- .6 Ontario Regulation 406/19. *On-site and Excess Soils*.
- .7 Ontario Regulation 407/19. *Records of Site Condition*. Part XV.1 of the Act.
- .8 Ontario Regulation 903. *Wells*.
- .17 *Occupational Health and Safety Act*. Revised Statutes of Ontario 1990, Chapter O.1.
- .1 Ontario Regulation 490/09. *Designated Substances*.
- .2 Ontario Regulation 278/05. *Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations*.
- .18 Ontario Ministry of Labour. 2011. *Lead on Construction Projects*.
- .19 Ontario Ministry of Labour 2011. *Silica on Construction Projects*.
- .20 Ontario Provincial Standard Specifications. Ontario Ministry of Transportation.
- .1 OPSS 182. General Specification for Environmental Protection for Construction in Waterbodies and on Waterbody Banks.
- .2 OPSS 518. Construction Specification for Control of Water from Dewatering Operations.
- .3 OPSS 801. Construction Specification for the Protection of Trees.

- .4 OPSS 805. Construction Specification for Temporary Erosion and Sediment Control Measures.

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities submit an Environmental Protection Plan to include the following:
 - .1 Spill Response Plan.
 - .2 Erosion and Sediment Control Plan.
 - .3 Soil Management Plan (SMP).
 - .4 Hazardous Materials Abatement and Management Plan.
 - .5 Waste Management and Disposal Plan.
 - .6 Waste Reduction and Source Separation Work Plan.
- .3 Record of Abatement and as-built drawings identifying abatement completed.
- .4 Submit other data, information, and documentation upon request by the DCC Representative and as stipulated elsewhere in this section.

1.3 ADMINISTRATIVE

- .1 Comply with all federal, provincial, and municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, including those, noted above.
- .2 The Work site is subject to inspection by the Base Environment Officer, or designate, and the DCC Representative, without prior notice.
- .3 Failure to comply with environmental requirements may result in a stop work order or assessment of damages commensurate with repair of damage.
- .4 The Contractor will be unable to request extra funding to meet environmental requirements that are within the contract.
- .5 It is the Contractor's responsibility to be aware of environmental requirements and the best management practices and pollution control measures necessary to meet them.
- .6 It is the Contractor's responsibility to obtain and abide by permits, licenses and compliance certificates at appropriate times and frequencies as required by the authorities having jurisdiction.
- .7 Blasting is not permitted on DND property.

- .8 Fires and burning of rubbish are not permitted on DND property.

1.4 VEHICLE REFUELLING

- .1 Refueling of vehicles or machinery is to be conducted above a secondary containment barrier.
- .2 Refueling and maintenance of vehicles and equipment will not be done within 30 m of a surface water drainage feature.
- .3 All onsite vehicles and equipment are to use POL drip mats while stationary for 4 hours or more or when not in use.

1.5 SPILL PREVENTION AND RESPONSE PLAN

- .1 A spill or release is an accidental discharge of a pollutant (solid, liquid or gas) into the environment. After a spill or release, always ensure human health and safety is protected above all else.
- .2 Submit to the DCC Representative a project-specific Spill Prevention and Response (SPR) Plan prior to work on-site.
 - .1 The SPR shall include environmental response measures necessary to prevent and to mitigate a pollutant release on National Defence property.
 - .2 The SPR is to include: roles and responsibilities, contact information, spill notification procedure, emergency spill response measures, project and site-specific clean up measures for spills, waste disposal, restoration activities, and reporting requirements.
 - .3 Identify storage locations of materials or wastes that may require emergency spill response. Identify spill control kit inventory and location(s).
 - .4 SPR shall identify equipment fueling location, methodology and control measures. Refueling operations shall be conducted within a secondary containment area. Refuel equipment no closer than 30 metres from water bodies.
 - .5 The SPR is to include measures to escalate the response in the event of an emergency that exceeds on-site control capabilities.
- .3 The SPR is to be modified and updated, as necessary. On-going assessments shall be performed during the progress of work identifying and documenting new or potential spill hazards and measures not previously known and identified.
- .4 Prior to starting work, provide to the DCC Representative an inventory of hazardous material to be brought to the site, including volume or mass, and Safety Data Sheets (SDS).
- .5 A Pollution Incident Report shall be completed by the Contractor for all spill or release incidents.

Emergency Response:

- .1 With respect to liquid spills, provide enough on-site equipment to control for one hour a liquid spill of 110% of any material brought on to—or handled at—the site.
 - .1 Requirement applies to sub-Contractors as well as the General Contractor.
- .2 The on-site spill control kit required to include absorbent pads, absorbent granular, nitrile gloves, garbage bags and/or pails with lids, and shovels, and applicable to the chemical used. A spill control kit shall be located wherever significant quantities of materials or wastes that may require emergency spill response are used or stored.
- .3 In the event of a spill, invoke Contractor's SPR Plan and make immediate notifications as per Contractor Environmental Hazard & Spill Response Guide, provided by the DCC Representative.
- .4 In the event of a spill into the natural environment, do everything practicable to prevent, eliminate, and ameliorate adverse effects, and to restore the natural environment.
- .5 Emergency response planning is to include measures to escalate the response in the event of an emergency that exceeds on-site equipment capabilities.
- .6 Display an information placard on all such material and equipment containing liquid products that will be located overnight or longer on DND property.
 - .1 Information placards to include: Contractor's name and address, contact person, emergency telephone numbers, and liquid contents.
 - .2 Post the information placard either on the exterior of the container, or on the dashboard of the vehicle, where applicable.

1.6 DESIGNATED SUBSTANCES

- .1 In accordance with Section 30 of Ontario's Occupational Health and Safety Act, following is a list of designated substances present at the project site:
 - .1 Asbestos-containing materials are present in the building but not found in the work area. If the contractor does come across items that they suspect being hazardous, they are to stop work and notify the DCC Representative immediately."
 - .2 Silica is present in all concrete materials throughout the project site.
 - .1 Disturbance of materials containing silica shall be conducted in accordance with the Ministry of Labour Guidelines "Silica on Construction Projects" (2011).
 - .3 Mercury Containing Lamps and Thermostats:
 - .1 Mercury is present within lighting lamps and bulbs, thermostats, thermometers, manometers and mechanical controls throughout the building.
 - .2 Disturbance of mercury-containing lamps shall be conducted in accordance with Environment and Climate Change Canada's "Code of

Practice for the Environmentally Sound Management of End-of-Life Lamps Containing Mercury” (2017).

- .3 Lighting tubes contain mercury, must not be released to the environment. Therefore, the tubes must not be broken.
- .4 Recycle all surplus mercury containing thermostats, lighting lamps and bulbs at a facility equipped to recover mercury.
- .5 Contractor is to identify the facility and provide a receiver receipt of materials.
- .4 Polychlorinated Biphenyls (PCBs):
 - .1 Before beginning work, submit written procedures to DCC Representative for review. Do not begin work on PCB ballasts material until DCC has reviewed the written procedures.
 - .2 Fluorescent light ballasts considered to contain polychlorinated biphenyls (PCBs) are to be packaged and disposed of at a PCB storage facility off Base.
 - .3 Label containers with black and white serialized, "ATTENTION PCB" labels, in accordance with Environment and Climate Change Canada Manual for Spills of Hazardous Materials.
- .2 Inform all workers and sub trades of the presence of designated substances and hazardous materials identified in the contract documents.
- .3 Immediately notify the DCC Representative of potential asbestos containing material (ACM) discovered during the work and not apparent from the drawings, specifications, or reports pertaining to the Work. Do not disturb such material.
- .4 For additional reference information, refer to report titled, Designated Substance and Hazardous Materials Survey prepared by Consultant, Arcadis dated March 2022.

1.7 HAZARDOUS MATERIALS ABATEMENT AND MANAGEMENT PLAN

- .1 Prior to work onsite contractor to create and submit to the DCC Representative a Hazardous Materials Abatement and Management Plan (HMAMP).
- .2 The HMAMP will address the details of how designated substance(s) and hazardous material(s) will be abated and managed. HMAMP to include:
 - .1 Name and contact information of:
 - .1 The designated qualified individual to be the Environmental Protection Coordinator (EPC).
 - .2 All subcontractors who will support the HMAMP.
 - .2 A list of all municipal, provincial and federal permits and notifications required to complete the Work.
 - .3 A list of all hazardous materials to be brought to site
 - .1 Include volumes and SDS, copy of placards and signage.
 - .4 Detail the approach to the execution of abatement work, including the equipment, tools, materials and actions to be employed for each type of designated substance or hazardous material.

- .5 A drawing identifying existing conditions with the location of proposed enclosure(s), barricades and/or warning signs to restrict access, waste and personal decontamination facilities, and proposed location of waste bins.
 - .6 Proposed schedule accounting for calendar day(s) projected for enclosure set up, abatement work, cleaning and lockdown, and enclosure tear down.
 - .7 Identify number of calendar days for the shutdown of any building systems (e.g. HVAC, fire alarms, etc.).
 - .8 If not defined in other Plans, provide details of waste disposal procedures for materials stored, used or abated including locations on the work site.
- .3 Provide DCC Representative a minimum of 48-hours' notice prior to request for pre-contamination inspections, post abatement visual inspections and inspections prior to lockdown application (including both Moderate and High-Risk Abatement activities as defined of COHSR).
- .1 Scheduling with the environmental consultant to be coordinated through the DCC Representative.
- .4 Contractor shall allow a minimum of 48-hours to receive results from DCC Representative for all visual inspections and clearance air testing results prior to enclosure tear-down (including both Moderate and High-Risk Abatement activities as defined of COHSR).
- .5 Inform all workers and sub trades of the presence of designated substances and hazardous materials identified in the contract documents.
- .6 Immediately notify the DCC Representative of potentially containing asbestos material discovered during the work and not apparent from the drawings, specifications, or reports pertaining to the Work. Do not disturb such material.
- .7 Fire alarm suspension can be coordinated on weekdays between 7:30am and 3:30pm daily.
- .1 Notification to DCC Representative, via submission of completed Request for Fire Alarm Shut Down form, is required a minimum of 5 days in advance of temporary fire alarm shut down.
- .8 Written notification to DCC Representative required a minimum of 5 days prior to request to disable the mechanical ventilation system servicing the work area.

1.8 HALOCARBON MANAGEMENT

- .1 Halocarbons are ozone-depleting substances that are used as refrigerants, solvents and for fire suppression.
- .2 Comply with the:
 - .1 Federal Halocarbon Regulations (FHR), 2022. SOR/2022-110.
 - .2 *Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems* (the Environment and Climate Change Canada "Refrigeration Code of Practice"). April 2015.

- .3 Installation, servicing, operation must be completed by a certified person as defined in the FHR 2022.
 - .1 Provide copies of all technicians' certificates to the DCC Representative.
- .4 For the purpose of this contract, the Responsible Person as defined in the FHR 2022 shall be the Contractor.
- .5 The following are the only halocarbons that are acceptable as refrigerants (non-halocarbon refrigerants are also acceptable):
 - .1 HFC 410A
 - .2 HFC 134A
 - .3 HFC 404A
- .6 Document **all** work—installation, maintenance, decommissioning, leak testing on refrigeration and air conditioning systems using ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG. Mount white copy of form on equipment, supply Yellow & Pink copies to DCC Representative and retain Orange copy for records. Obtain forms from DCC Representative.
- .7 Immediately report all releases of halocarbons to the DCC Representative.
 - .1 Complete ANNEX B7-1: Halocarbon/Halon Release Report and provide to DCC Representative within 24 hours.
- .8 Leak-test all halocarbon-containing equipment within 24 hours of arrival at the Base, in accordance with the FHR 2022 and the *Refrigeration Code of Practice*.
- .9 Leak-test all nitrogen-charged or “empty” equipment within 24 hours of arrival at the Base, in accordance with the FHR 2022 and the *Refrigeration Code of Practice*.
- .10 Leak-test halocarbon-containing equipment during Commissioning in accordance with the FHR 2022 and the *Refrigeration Code of Practice*.
- .11 After installation, leak-test factory-charged halocarbon-containing equipment in accordance with the FHR 2022 and the *Refrigeration Code of Practice*.
- .12 Comply with the following timelines for service activity log completions,
 - .1 Factory charged units containing more than 10 kg of halocarbon shall be leak tested within 2 (two) working days of delivery to site.
 - .2 Commissioning of units requires forms to be submitted to DCC Representative within 48 hours of service.
 - .3 Leak Test with “no leaks,” submit forms to DCC Representative within 48 hours of service.
 - .4 Leak Test with “leak detected,” submit forms to DCC Representative within 24 hours of service.
 - .5 Leak repaired and isolation or emptying of system, submit forms to DCC Representative within 5 days of service.

- .6 Release of halocarbons >10 kg and <100 kg, submit forms to DCC Representative within 24 hours of service.
- .7 Release or potential release of halocarbons > 100 kg, submit forms to DCC Representative immediately.
- .8 Decommissioning of units requires forms to be submitted to DCC Representative within 48 hours of service.
- .13 Affix bar code tags to the equipment, as provided by the DCC Representative.

1.9 EROSION AND SEDIMENT CONTROL PLAN

- .1 Establish and submit to the DCC Representative an Erosion and Sediment Control (ESC) Plan prior to work on-site.
 - .1 ESC Plan to identify type and location of site work that requires erosion and sediment controls.
 - .2 The ESC plan shall include any and all erosion and sediment control measures necessary to ensure that sediment-laden water is not discharged from the site. This shall include but is not limited to sediment and erosion control measures indicated on the contract drawings.
 - .3 Contractor to maintain and submit a Work Record to the DCC Representative showing date of construction, repairs, or alternations (initialization and completion) and removal of each erosion and sediment control measure.
 - .1 Digital photographs of all ESC measures at time of construction, of major repair or alternation and just prior to removal.
 - .2 Checklists of all ESC measures in place at that time, recording date, time and persons inspecting ESC measures. Required repairs to be indicated on both checklist and on Work Record for each ESC measure.
 - .4 Dewatering of groundwater and surface water from excavations require a dewatering system and associated holding area to prevent sediment discharge to storm sewers, ditches and/or watercourses.
 - .5 Dewatering systems must be capable of controlling ingress of water during work, as well as prevent surface runoff into excavation.
 - .6 Include monitoring and reporting requirements to ensure that control measures are in compliance with ESC Plan, as well as Federal, Provincial, and Municipal laws and regulations.
 - .7 The ESC plan must be modified and updated as necessary if existing sediment and erosion control measures are proving inadequate.

- .2 Contractor to designate a qualified individual to be the Environmental Protection Coordinator (EPC) for the contract.
- .3 Prevent the release of water containing suspended materials into any waterways, storm drains, sanitary sewers, or drainage systems. Control disposal and/or runoff of water containing suspended materials or other harmful substances in accordance with regulatory requirements.
- .4 Berm barriers are not permitted.
- .5 Store any stockpiles of soil or fill material at least thirty (30) metres from water bodies and protect them with either a heavy duty or light duty sediment barrier.
- .6 Have additional sediment control materials readily available in case they are needed promptly for erosion and sediment control.
- .7 Maintain sediment controls in good condition until terrestrial vegetation has re-established.
- .8 Remove captured sediment before dismantling sediment barriers.

1.10 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 waterways, sewer, or drainage systems.
- .3 Protect storm drains against entry by sediment, debris, oil, or chemicals.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
- .5 All dewatering activities must comply with the CFB Borden Supplemental Dewatering Guidance.

1.11 WASTE MANAGEMENT AND DISPOSAL

- .1 Submit a Waste Management and Disposal (WMD) Plan to the DCC Representative before construction work begins at the site.
- .2 The WMD Plan is to encompass:
 - .1 Regular waste.
 - .2 Construction waste.
 - .3 Hazardous materials used in the course of the work.
 - .4 Hazardous materials and designated substance waste.

- .3 The Plan is to comply with legislation, best practices, and with the requirements of the specifications.
- .4 Provide evidence in the WMD Plan that all proposed temporary storage procedures, transport methods, and disposal sites are licensed where applicable.
 - .1 Include copies of licenses.
- .5 The WMD Plan is to include handling, storage, transportation, disposal, and emergency response. Specific minimum requirements to be addressed are listed below.

Handling:

- .6 Ensure that staff are properly trained and equipped, in accordance with regulatory requirements.
- .7 Minimize handling and exposure to hazardous materials. Use control measures such as PPE and best practice procedures to address potential risks.
- .8 All waste products will be placed in suitable containers and labeled clearly.
- .9 Waste products are to be segregated by commodity and placed in separate containers based on class.
- .10 Similar waste products are not to be mixed together without prior approval from the DCC Representative.

Storage:

- .1 Identify location(s) on site where wastes and hazardous materials wastes will be stored.
- .2 Store all petroleum, oil, lubricants, and other hazardous materials within secondary containment, or in an appropriate metal clad storage building with containment.
- .3 Store incompatible materials separated to prevent reaction.
- .4 Access to hazardous waste storage areas must be controlled through appropriate physical barriers and limited to authorized personnel.
- .5 Site is to be kept neat and orderly at all times.

Transportation:

- .1 Transportation of hazardous material must be in accordance with the *Transportation of Dangerous Goods Act*, by a licensed hauler, and in approved containers.
- .2 Hazardous Materials Waste shall not be released from a work site to a carrier that is not registered as a carrier for the specific Hazardous Materials Waste, nor shall it be released for delivery to a consignee that is not registered as a receiver for the specific Hazardous Materials Waste.

Disposal:

- .1 Identify the proposed waste receiver facilities and the anticipated waste shipment frequency for all wastes.
- .2 Contractor is required to have painted waste sampled and analyzed for toxicity characteristic leaching procedure (TCLP) metals analysis in accordance with O. Reg. 347.
 - .1 Sample(s) are to be taken by a Qualified Person (QP) (as defined in O. Reg. 153).
 - .2 Results are to be provided to DCC Representative for review prior to disposal off-site.
- .3 Disposal of leachate toxic lead-based paint as hazardous materials must comply with legislation on transport and disposal.
- .4 Dispose of all materials that are removed as asbestos-containing materials as asbestos waste.

Transport and Disposal of Hazardous Waste and Designated Substances:

- .1 Provide DCC Representative written notification of intent to transport of hazardous materials or designated substances off site, including but not limited to hazardous and liquid industrial waste (i.e. oils, solvents, waste fuels, used spill clean-up materials) or designated substance waste (i.e. asbestos, leachate toxic lead paint, mercury vapour in fluorescent light tubes).
- .2 For shipments that require a waste generator number pursuant to O. Reg. 347, the Base waste generator number is required prior to removal offsite and will be provided by the DCC Representative.
- .3 Submit the following to the DCC Representative for review 5 days prior to transport:
 - .1 Description and approximate quantity of waste material, including substrate if applicable.
 - .2 Waste carriers' business name, address, contact information, and Ministry of Environment, Conservation and Parks (MECP) Certificate of Approval(s) listing the hazardous materials approved for transport.

- .3 Contractor proposed date and time for hazardous waste material shipment.
- .4 Hazardous waste receivers name, address, contact information, and MECP Certificate of Approval(s) listing the hazardous materials approved for their receiving site.
- .5 Correspondence from the approved hazardous waste receiver, indicating agreement and intent to accept the specified hazardous materials waste on specified date.
- .6 Contractor will complete a "Certificate of Content for Waste Disposal" provided in this specification.
- .4 Coordinate with the DCC Representative so that the Base Hazardous Materials Officer or designate is present at the time of shipment to review, sign and document hazardous waste transport from the Base.
- .5 Submit the following to the DCC Representative for review within 48 hours following transport from the Base:
 - .1 Landfill weigh scale receipt/ticket for the disposal of waste.

Disposal of Mechanical Flushing Liquids:

- .1 Mechanical flushing liquids and mechanical liquids include any mechanical systems (piping, units, etc.) such as HVAC, glycol and includes residual liquid in current systems, cleaning with chemical inhibitors or cleaners, and flushing of new piping.
- .2 Mechanical flushing liquids are to be assumed for bidding purposes to be hazardous waste and shall be transported and disposed of at a licensed facility in accordance with O. Reg. 347, and as described in this specification for Shipment and Disposal of Hazardous Waste and Designated Substances.
- .3 In the event the contractor wants to discharge to a sanitary sewer the contractor must undertake the following items:
 - .1 Provide DCC Representative written notification of intent to discharge mechanical flushing liquids to sanitary sewer.
 - .2 Submit a sample of the liquid for laboratory analysis of all parameters in THE CORPORATION OF THE TOWNSHIP OF ESSA Sewer Bylaw including pH to a licensed laboratory.
 - .3 Submit a report to DCC Representative confirming that all materials proposed to be disposed to sewers comply with all legislative requirements, including THE CORPORATION OF THE TOWNSHIP OF ESSA Sewer Use Bylaw.
 - .4 Coordinate with the DCC Representative to involve the Hazardous Materials Officer to authorize results from testing and sanitary discharge. Allow a minimum of 48 hours for review and authorization.

- .5 Mechanical flushing liquids and mechanical liquids that are not authorized to be discharged to sanitary sewer shall be transported and disposed of at a licensed facility in accordance with O. Reg. 347, and as described in this specification for Shipment and Disposal of Hazardous Waste and Designated Substances.

Special Wastes:

.1 Smoke Detectors

- .1 Undamaged and intact commercial Canadian Standards Association (CSA) and Underwriters Laboratories (UL) approved smoke detectors containing less than 185 kilo-Becquerel's of Americium-241 may be disposed of using local waste collection systems.
- .2 Photoelectric smoke detectors are not subject to this special procedure.
- .3 Ionization chamber smoke detectors (ICSDs) contain radioactive sources and are subject to this special procedure.
- .4 If surplus ICSDs are not to be re-used, remove the ICSDs from walls, ceilings, etc., without breakage, and dispose of ICSDs at an approved landfill.

.2 Polychlorinated Biphenyls (PCBs):

- .1 Before beginning work, submit written procedures to DCC Representative for review. Do not begin work on PCB ballasts material until DCC has reviewed the written procedures.
- .2 Fluorescent light ballasts considered to contain polychlorinated biphenyls (PCBs) are to be packaged and disposed of at a PCB storage facility off Base.
- .3 Label containers with black and white serialized, "ATTENTION PCB" labels, in accordance with Environment and Climate Change Canada Manual for Spills of Hazardous Materials.
- .6 Do not bury rubbish or waste materials on DND Property.
- .7 Do not dispose of waste into any waterways, storm or sanitary sewers, drainage system, or onto land.
- .8 Divert unused asphalt material from landfill to be reused offsite or recycled.
- .9 All solid and liquid hazardous waste material generated by work are to be taken off Base and disposed of in a lawful manner and at appropriately accredited facilities.
- .10 All expenses incurred for the handling, storage, analysis, transport, and disposal/recycling of all wastes will be incurred by the Contractor.

1.12 WASTE REDUCTION AND SOURCE SEPRATION WORK PLAN

- .1 In accordance with Ontario Regulation 103/94 “*Industrial, Commercial, and Institutional Source Separation Programs*”, before work begins at the site, implement a “Source Separation Program” covering the waste that will be generated in the construction project. Include in the program not less than: brick and Portland cement concrete; cardboard (corrugated); drywall (unpainted); steel; wood (not including painted or treated wood or laminated wood).

1.13 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Trees to be protected must have secure enclosures surrounding trees located a minimum of 1.5 metres from the trunk. Comply with standards in OPSS 801 “*Construction Specification for the Protection of Trees*”.
- .3 Protect roots of designated trees to dripline to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Root pruning may be required when working in close proximity to a tree’s drip line. Clean saw cuts are required for all root pruning.
 - .1 Contractor must identify to the DCC Representative prior to excavations where the limit of root cut will be for potentially impacted trees.
 - .2 If it is determined root pruning is required, work shall be carried out in the presence of the DCC Representative.
 - .3 Once the limit of the root cut has been defined, the Contractor shall not under any circumstances cut the tree roots a second time without the prior approval of the DCC Representative.
- .5 Do not use tree protection areas for storage, stockpiling or any other purpose. Do not dump or flush any contaminants in areas of tree feeder roots.
- .6 Obtain DCC Representative’s approval where it is necessary to encroach onto protected area, prior to proceeding.
- .7 Do not attach rigging cables to trees.
- .8 Woody vegetation less than 10 cm Diameter at Breast Height (DBH) are to be mulched or chipped and distributed onsite with material not to exceed piles of 0.5 metres in height above ground level.
- .9 Trees removed that are greater than 10 cm DBH must be cut into 1.5 m lengths and be disposed of in the nearby forest on DND property to serve as habitat. Cut tree trunk material is not to exceed piles of 0.5 metres in height above ground level.
- .10 Trees labeled in blue paint or numbered are not to be cut down or removed. If encountered, the Contractor is to stop work and notify the DCC Representative immediately.

1.14 WILDLIFE PROTECTION

- .1 Nesting structure for birds are to remain intact without harm to the nest.
 - .1 If these features are encountered the Contractor is to stop work and notify the DCC Representative immediately for direction on how to proceed.
 - .2 Depending on the nest and bird species, setbacks for disturbance zones maybe defined.
- .2 The Contractor will comply with the *Migratory Birds Convention Act*, 1994.
- .3 Prior to work commencing, conduct ground surveys to ensure that wildlife are not nesting/denning on or immediately adjacent to the project site.
 - .1 Where found, immediately notify the DCC Representative.
 - .2 Maintain a minimum setback distance of 3 m from wildlife burrows/dens and maintain markers indicating wildlife burrows/dens.

1.15 POLLUTION PREVENTION - WATER

- .1 Protection of Storm Drains
 - .1 Protect storm drains within work site and within roadway that borders work site (which may be outside of work site) against entry by sediment, debris, oil, or chemicals prior to any work on-site and maintain until completion of work.
 - .2 Discharge of sediment-laden water to storm sewer is not permitted.
 - .3 Catch basins and catch basin manholes within work site and within roadway that borders work site (which may be outside of work site) to have a double layer of geotextile placed under lids to prevent sedimentation of storm sewer system. The geotextile shall be maintained until the completion of work.
 - .4 Ditch inlets to be protected by flow check dam immediately upstream of ditch inlet until all areas draining into the ditch inlet have been permanently stabilized.
- .2 Protection of Drinking Water
 - .1 In the event of a water main break, leak or disruption, Contractor is to stop work and notify the DCC Representative immediately.
 - .2 Water mains are to be disinfected with a 12% solution of sodium hypochlorite specific for drinking water supplies.

- .3 Coordinate with DCC Representative to have the Department of National Defence's water authority; Water, Fuel and Environment (WFE) witness the connection, disinfection and flushing procedures as well as collect residual chlorine and bacteria samples.
- .4 Repeat disinfection procedure of water main as required in order to achieve acceptable test results.
- .3 Protection of Groundwater Monitoring Wells
 - .1 Protect any and all existing groundwater monitoring wells at the site.
 - .2 The Contractor is responsible to repair any damage to existing monitoring wells. Work to be completed in compliance with Ontario Regulation 903.
 - .3 The DCC Representative will, upon request, show the Contractor the location of all known monitoring wells.
- .4 Protection of Waterbodies
 - .1 Do not operate construction equipment in waterways.
 - .2 Do not use waterway beds for borrow material.
 - .3 Do not dump excavated fill, waste material or debris in waterways.
 - .4 Chlorinated drinking water is considered a deleterious substance by Environment and Climate Change Canada (ECCC).
 - .5 Contractor is to ensure that hydrant discharge does not enter or is likely to enter fish habitat by direct or indirect discharge with measurable levels of free reactive chlorine (CCME).
 - .6 Discharging to land is permitted subject to the use of matting to prevent loss of soil or vegetation ensuring that items above are complied with.
 - .7 Comply with requirements of OPSS 182 "General Specification for Environmental Protection for Construction in Waterbodies and on Waterbody Banks". A written strategy is required by paragraph 182.04 to be submitted to the DCC Representative before commencing work on site. Disregard references to OPSF 182-1.

1.16 POLLUTION PREVENTION - LAND

- .1 Take all measures necessary to prevent dust and mud tracking on adjacent roads and streets.
 - .1 Use mechanical sweepers as often as necessary to keep adjacent roads and streets clean of dust and mud that is deposited from this project.

- .2 Spray water to minimize the release of dust from paved areas or exposed soils.
 - .1 Chemical dust suppressants to be used only as approved by the DCC Representative.
- .3 Maintain temporary erosion and pollution control features installed under this Contract, and those in place pre-dating the Contract.
- .4 If materials are to be transported between sites, prevent any loss of material during transit.
- .5 Cover or wet down dry materials or rubbish to prevent blowing dust and debris.
 - .1 Cover or otherwise contain loose materials that have potential to release airborne particulates during their transport, installation, or removal.
 - .2 Stabilize soil and other material storage piles against wind erosion.
 - .3 Minimize vehicle traffic on exposed soils and stabilize high traffic areas with clean gravel surface layer or other suitable cover material.
 - .4 Avoid excavation, or other construction activity with potential to release airborne particulates, during windy and prolonged dry periods.
 - .5 Restore disturbed areas as soon as possible to minimize the duration of soil exposure.
 - .6 Lawn care pesticides are prohibited.
 - .7 Secure covers on waste bins and dumpsters at the end of each working day so as to prevent unauthorized use.
 - .8 Secure covers on waste bins and dumpsters so as to shed rain.

1.17 POLLUTION PREVENTION - AIR

- .1 Prevent material from sandblasting, saw-cutting, and other operations from contaminating air beyond application area, by providing temporary enclosures.
- .2 Use new or well-maintained heavy equipment and machinery, preferably fitted with muffler/exhaust system baffles, engine covers.
- .3 Comply with operating specifications for heavy equipment and machinery.
- .4 Minimize the operation and idling of vehicles and avoid operating and idling vehicles and gas-powered equipment during smog advisories.
- .5 Control emissions from equipment and plant to conform with federal, provincial, and municipal requirements.

.6 Products and Materials:

- .1 Use products and materials that are as free as possible of noxious or toxic volatile emissions or emissions of irritating or toxic particles, so that the interior air of the completed building is as pollution-free as possible. For example, products emitting benzene, mercury, lead, or other known toxic compounds are not acceptable.
- .2 Where odourless products are not available, choose products where possible so that odours are minimized. Set ventilation levels during the construction period sufficiently high to encourage the off-gassing of materials to their minimum levels prior to occupancy of the building, where possible.
- .3 Choose products for installation within the air-handling and distribution systems to minimize the introduction of pollutants into the fresh air supply to the building.
- .4 Remove oily rags and other combustible debris from Site daily. Take every precaution necessary to prevent spontaneous combustion.

1.18 UNDERGROUND OIL-WATER INTERCEPTOR INSTALLATIONS

- .1 All petroleum product and allied petroleum product storage tanks and interceptors shall be installed by a person approved to do so in the province of Ontario.
 - .1 Provide certificates to the DCC Representative before commencing installation work.

1.19 UNANTICIPATED UNEXPLODED ORDNANCES (UXO)

- .1 Should unanticipated UXO be discovered:
 - .1 Stop work and assess the situation for safety. Do not touch or remove UXO.
 - .2 If situation does not appear to be safe, evacuate workers from area.
 - .3 If safe to do so, take immediate steps to section off the area of the UXO with barriers to access.
 - .4 Immediately contact the DCC Representative who will notify Base authorities.

END OF SECTION

1 **References**

FEDERAL

- .1 Canadian Council of Ministers of the Environment (CCME). *Canadian Environmental Quality Guidelines (CEQGs)*.
- .2 DCS CSI (CSI.004.001) – Soil Management V 3.1 20 July 2023
- .3 *Canadian Environmental Protection Act 1999*. Statutes of Canada 1999 Chapter 33.
- .4 Health Canada's drinking water guidelines and screening values. April 2019.
- .5 *Transportation of Dangerous Goods Act* and pursuant regulations.

PROVINCIAL

- .6 *Aggregate Resources Act*, R.S.O. 1990, c. A.8.
- .7 *Environmental Protection Act*. Revised Statutes of Ontario 1990, Chapter E.19.
 - .1 Ontario Regulation 153/04. *Records of Site Condition*. Part XV.1 of the Act. Amended to Ontario Regulation 407/19. *Records of Site Condition*. Part XV.1 of the Act.
 - .2 Ontario Regulation 347. *General—Waste Management*. Revised Regulations of Ontario 1990.
 - .3 Ontario Regulation 406/19. *On-site and Excess Soils*.
- .8 Ontario Landscape Horticultural Association. 2004. *Ontario Landscape Standard Chapter 5 Topsoil Standard*.
- .9 Ontario Ministry of Transportation. *Ontario Provincial Standard Specifications (OPSS)*. Technical Publications.
- .10 *Ontario Water Resources Act*. Revised Statutes of Ontario 1990, Chapter O.40.
- .11 *Technical Standards and Safety Act, 2000* and pursuant regulations, codes, and standards. Statutes of Ontario 2000, Chapter 16.

2 Submittals

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities, the following submittals are to be submitted and confirmed by the DCC Representative:
 - .1 Soil Management Plan
 - .1 Soil Sampling Plan
 - .2 Imported Fill Sampling Plan.
- .3 Submit other data, information and documentation upon request by the DCC Representative and as stipulated elsewhere in this section.
- .4 At the completion of the work, Contractor to submit a Summary Soil Management Report as part of contract closeout submissions.

3 General Soil Management

- .1 Comply with all federal, provincial, and municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, including in section 1.0 References, noted above.
- .2 The Work site is subject to inspection by the Base/Wing Environment Officer, or designate, as well as the DCC Representative, without notice.
- .3 Failure to comply with environmental requirements may result in a stop work order or assessment of damages commensurate with repair of damage.
- .4 All references to payment referred to in OPSS references are to be disregarded and do not apply to this contract.
- .5 The Contractor will be unable to request extra funding to meet environmental requirements that are within the contract.
- .6 It is the Contractor's responsibility to be aware of environmental requirements and the best management practices and pollution control measures necessary to meet them.
- .7 Blasting is not permitted on DND property.
- .8 Fires and burning of rubbish are not permitted on DND property.

4 Management of Reuse and Excess Soil

.1 For bidding purposes assume existing soil is non-hazardous and meets MECP Table 3

- .2 Federal and provincial regulations will be adhered to for the export and import of fill and soil from the work site. For excess soil removed from the site, Ontario Regulation 406/19 – *Onsite and Excess Soil Management* will be adhered to.
- .3 Excavated soil must be sampled as defined in Section 6 prior to reuse on site or disposal offsite. Soil must be stockpiled in designated area, indicated by the DCC Representative.
 - .1 Excavated materials leaving the project site must be sampled and disposed of in accordance with provincial and federal standards by the Contractor.
- .4 The Contractor shall submit to the DCC Representative for review a Soil Management Plan (SMP) prior to any soil reuse onsite, removing soil offsite or importing any soil, fill material, or topsoil onto DND Property.
 - .1 The SMP will include soil characterization, soil quantities, considerations for water table excavations, disposal options for excess soil, stockpile locations and plan and soil re-use plan.
 - .2 The Contractor will allow a minimum of 5 business days for review of the SMP and associated documentation by the DCC Representative.
 - .3 The Contractor must have a Qualified Person (QP) sign off on the Plan as defined by O. Reg. 153/04 and O. Reg 406/19.
 - .4 The Contractor will provide DCC with written documentation from the Receiving Site confirming that excess soil can be accepted at the facility based on the soil analytical results.
 - .5 The Contractor will provide the DCC Rep with copies of all manifests, weight tickets and waste hauler and disposal licenses.
- .5 All soil movement on DND Property must be tracked. Submit a Summary Soil Management Report to include soil volumes transported and disposed of, source and receiver site location and soil movement dates as a closeout submission.
- .6 All temporary stockpiled soil must be placed on an impermeable surface and covered with an impermeable, properly secured tarp.

- .1 Temporary storage must be at least 30 meters away from watercourse and waterbodies.
- .7 Prevent disturbance and compaction of topsoil and underlying soil from vehicles and heavy equipment using load dispersion materials.

5 Importing Fill Material

- .1 All aggregate/fill materials imported onto DND property must be uncontaminated.
- .2 Imported fill material must be checked by the Contractor and DCC Representative to ensure there are no visual or olfactory indications of contamination.
 - .1 Contractor to provide written confirmation once completed.
- .3 All fill materials will require sampling and laboratory analysis, except the exempted materials listed below. These materials must be from a virgin source and not be recycled.
 - .1 Topsoil;
 - .2 Imported fill less than 10 m³;
 - .3 Gravel/aggregates larger than 2 mm (i.e. does not pass a US #10 sieve);
 - .4 Fines and materials generated by the mechanical activity of crushing virgin rock (i.e. crusher dust); or
 - .5 Gravel/aggregate material with less than 20% fines (US #10/ 2 mm sieve) by volume or mass.
- .4 The Contractor is to provide written justification from the Source Site identifying how the imported material is exempt from sampling.
- .5 All aggregate or fill materials not excluded, must be sampled under the supervision of a QP (as defined under the O. Reg 153/04) at the Source Site prior to coming onto DND lands.
- .6 Submit a letter report stating that the imported fill material meets CCME Agricultural Land use criteria or acceptable ambient background conditions based on intended use.

- .1 The letter report shall include analytical data reported as well as Certificates of Analysis issued by the certified laboratory.
- .2 Sampling results for imported fill must be no more than 3 months old.
- .3 The report characterization and recommendations must be signed off by a QP.
- .4 The report shall identify any sampling plan changes and results of sampling.

6 Sampling and Test Results

- .1 Soil testing shall be conducted for imported fill, soil reuse on site and excess soil taken of site to identify soil quality conditions.
- .2 As part of the SMP, the Contractor is required to submit a Soil Sampling Plan that will detail the sampling and characterization of any excess soil to be removed from or imported to the work site that has not already been characterized within the contract documents.
 - .1 The Plan will include:
 - .1 The name of the licensed/permitted Source Site and Receiver Site from which the material will be provided;
 - .2 The number of samples required to compare to CCME guidelines or O. Reg 406/19, as needed;
 - .3 The soil parameters to be assessed;
 - .4 A description of the type imported material (aggregate, fill) and proposed quantity;
 - .5 Documentation on imported fill will be reviewed by the DCC Representative and DND Environment Officer prior bringing to site.
- .3 All samples shall be submitted to a Canadian Association for Laboratory Accreditation (CALA) or similar accredited laboratory for analysis.
- .4 All samples are to be tested at a minimum for the following parameters: Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Petroleum Hydrocarbons and BTEX, and Metals and Inorganics. In

addition, testing for Per- and polyfluoroalkyl substances (PFAS) will also be required.

- .1 Sampling for PFAS should include the following compounds, at a minimum:

PFAS Name	PFAS Acronym	Criteria mg/kg
Perfluorooctane sulfonate	PFOS	0.01
Perfluorooctanoic acid	PFOA	0.01
Perfluorobutanoate	PFBA	0.01
Perfluorobutane sulfonate	PFBS	0.01
Perfluoropentanoate	PFPeA	0.01
Perfluorohexane sulfonate	PFHxS	0.01
Perfluorohexanoate	PFHxA	0.01
Perfluoroheptanoate	PFHpA	0.01
Perfluorononanoate	PFNA	0.01

- .5 Sampling frequencies will be in accordance with Ontario Regulation 407/19 Table 2: Minimum Stockpile Sampling Frequency, or as required by the QP as defined by O. Reg. 153/04 and O. Reg 406/19.

7 Unanticipated Soil Contamination

- .1 Refer to General Condition GC 4.4
- .2 Should unanticipated soil contamination be discovered:
- .1 Stop work and assess the situation for safety.
 - .2 If situation does not appear to be safe, evacuate workers from area.
 - .3 If safe to do so, take immediate steps to control any spread of contamination, in accordance with Contractor's spill response plan.
 - .4 Immediately contact the DCC Representative for direction on how to proceed.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Statutes of Canada 1999 Chapter 33. “Canadian Environmental Protection Act 1999”
 - .1 SOR/2022-110. “Federal Halocarbon Regulations 2022”
- .2 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (the Environment Canada “Refrigeration Code of Practice”)

1.2 LEGISLATION COMPLIANCE

- .1 Comply with all of:
 - .1 Federal Halocarbon Regulations 2022;
 - .2 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (the Environment Canada “Refrigeration Code of Practice”) Report EPS 1/RA/2 April, 2015.

1.3 DOCUMENTATION

- .1 Installation, servicing, etc., only by, or under the supervision of, a technician licensed by the Province of Ontario, 313A or Red Seal, as a refrigeration mechanic ALSO in possession of a ODP certificate issued by the Heating, Refrigeration, and Air Conditioning Institute of Canada.
 - .1 Provide copies of all technicians’ certificates to the DCC Representative.
- .2 The following are the only halocarbons that are acceptable as new refrigerants (non-halocarbon refrigerants are also acceptable), existing systems may continue to use the current refrigerant:
 - .1 HFC 410A
 - .2 HFC 134A
 - .3 HFC 404A
- .3 Document all work—installation, maintenance, commissioning, decommissioning, leak testing etc.—on refrigeration and air conditioning systems in accordance with the CFB Borden BBSAI 1005 “Halocarbon and Ozone Depleting Substance Management” and “Halocarbon Data Sheet”. Obtain the following DND form from the DCC Representative – ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG Mount white copy of form on equipment, supply Yellow & Pink copies to DCC Representative and retain Orange copy for records.
- .4 Leak-test factory-charged halocarbon-containing equipment in accordance with the Refrigeration Code of Practice within one working day after delivery to the site, use DND form (ANNEX A3-7” REFRIGERATION AND AIR CONDITIONING SERVICE LOG) to document test. Supply Yellow & Pink copies to DCC Representative.

- .5 After installation, leak-test both factory-charged and non-factory-charged halocarbon-containing equipment in accordance with the Refrigeration Code of Practice
 - .1 The DCC Representative will not issue the Interim Certificate of Completion until the equipment is documented to be leak-free, documentation must be on approved DND form (ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG) and Yellow & Pink copies have been supplied to DCC Representative.
- .6 Conduct annual leak tests, on or before expiration of previous certificate date and record on DND form ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG, of halocarbon-containing equipment in accordance with the Federal Halocarbon Regulations, 2022 until such time as the Interim Certificate of Completion is issued.

1.4 HALOCARBON RELEASE REPORTING

- .1 Immediately report all releases of halocarbons to the DCC Representative regardless of volume. Provide a worst case release volume **as well as** an anticipated release volume.
- .2 Conduct an investigation, quantify the volume released, and provide a written record of the release within 5 days. The following forms can be obtained through the DCC representative:
 - .1 The DND form ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG;
 - .2 The ANNEX B7-1: Halocarbon/Halon Release Report; and
 - .3 A CFB Borden Spill Report Form.
- .3 The Contractor is responsible to report all applicable halocarbon releases to the appropriate authorities.
- .4 Copies of all correspondence (including any follow-up) and reports related to a halocarbon releases are to be provided to DCC within 1 working day of transmission.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 91 00 Commissioning

1.2 DEFINITIONS

- .1 **Quality Control (QC):** QC refers to the actual monitoring of specific project results to determine if they comply with relevant quality standards. There are a number of deliverables associated with the QC sub-system, most of these are generally already used on typical construction projects. The deliverables include, shop drawing reviews, on-site inspections and tests and related reports, site meeting minutes etc.
- .2 **Quality Assurance (QA):** QA refers to the documented intent outlining the activities that are implemented in the QCP to provide confidence that the project will satisfy the relevant quality standards and specifications.
- .3 **Quality Control Plan:** The Quality Control Plan (QCP) consists of the organizational structure and the inherent responsibilities, procedures, processes and resources needed to implement quality control management of the building process. In addition, and for the purpose of this project, "Commissioning" will be considered an integral element of the quality management system.
 - .1 The Contractor shall establish and maintain a documented QCP to ensure that the specified quality standards for the project are achieved, in compliance with the terms and conditions of the contract.
 - .2 Under the terms of the Contract, the Contractor is responsible for the delivery of a facility that meets the standards of quality demanded by the specification as it applies to the materials, workmanship, and completed results. The purpose of the QCP is to assist in the fulfillment of this obligation and to provide to the DCC Representative a means to confirm the specified level of quality will be achieved.

1.3 INSPECTION

- .1 The Contractor must allow the DCC Representative access to Work site. If part of Work is in preparation at locations 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 DCC 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 DCC Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of

examination and correction. If such Work is found in accordance with Contract Documents, DCC Representative shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 The contractor to furnish and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Control (QC) testing in accordance with the contractor's quality control plan.
- .2 DCC Representative will appoint and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Assurance (QA) testing.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by DCC Representative at no cost to DCC Representative. Pay costs for retesting and re-inspection.

1.5 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

- .1 Notify appropriate agency and DCC Representative in advance of requirement 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.

1.7 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 DCC 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 opinion of DCC Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, DCC Representative 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 DCC Representative.

1.8 REPORTS

- .1 Submit electronic pdf format inspection and test reports to DCC Representative.
- .2 Provide copies to Subcontractor of work being inspected or tested or manufacturer or fabricator of material being inspected or tested.

1.9 CONTRACTOR RESPONSIBILITIES

- .1 Contractor is responsible for the execution of the Construction Quality Plan. Contractor is to pay all costs for the execution of the Construction Quality Plan. Contractor shall designate an experienced site representative for carrying out the Construction Quality Plan.

1.10 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by DCC Representative and may be authorized as recoverable.

1.11 MILL TESTS

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

1.12 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to Section 01 78 00 - Closeout Submittals for definitive requirements.

Part 2 NOT USED

Part 3 NOT USED

END OF SECTION

Part 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 can be made available to the Contractor at no charge, subject to operational requirements. Arrange for connection and pay all costs for installation, maintenance and removal. 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 DCC 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 DCC 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 degrees 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 or 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 DCC 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 system 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 DCC Representative.
- .9 Pay costs for maintaining temporary heat, when using permanent heating system. DCC 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 to 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 can be made available to the Contractor at the current Ontario Hydro rates being charged to CFB Borden. 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 DCC Representative whose written permission must be obtained before any connection is made.
- .3 The Contractor shall be responsible for the installation of Service Entrance equipment including the meter base.

- .4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of DCC 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 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.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA-S269.2-(R2021), Access Scaffolding for Construction Purposes.
 - .2 CAN/CSA-Z321:21, Signs and Symbols for the Occupational Environment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain ladders, scaffolding, and temporary stairs.

1.5 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists to be operated by qualified operator.

1.6 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 weight or force that will endanger Work.

1.7 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in 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 manner to cause least interference with work activities.

1.9 SANITARY FACILITIES

- .1 Access to existing sanitary facilities within the building is not permitted.
- .2 Provide portable sanitary facilities for work force in accordance with governing regulations and ordinances.
- .3 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.10 CONSTRUCTION SIGNAGE

- .1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by DCC Representative.
- .2 No other signs or advertisements, other than warning signs, are permitted on site.
- .3 Direct requests for approval to erect Contractor signboard to DCC Representative. For consideration general appearance of Contractor signboard must conform to project identification site sign. Wording in both official languages.
- .4 Signs and notices for safety and instruction in both official languages, Graphic symbols to CAN/CSA-Z321.
- .5 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 DCC Representative.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 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
- .3 Protect travelling public from damage to person and property.
- .4 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .5 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .6 Construct access and haul roads necessary.
- .7 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

- .8 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .9 Dust control: adequate to ensure safe operation at all times.
- .10 Location, grade, width, and alignment of construction and hauling roads: subject to approval by DCC Representative.
- .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.
- .13 Remove, upon completion of work, haul roads designated by DCC Representative.

1.12 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.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 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 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 Standard Leasable Temporary chain link fencing 2m x 3m (6'x10') sections. Provide one lockable truck gate. Maintain fence in good repair.
- .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 closures 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.

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.

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 private and 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, covers, and hoardings.
- .3 Confirm with DCC Representative the locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

END OF SECTION

Part 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 DCC 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 Review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify DCC Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify DCC Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, DCC 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 store 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 from weather 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 DCC Representative.
- .9 Touch-up damaged factory finished surfaces to DCC 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 cost of products supplied by DCC Representative will be paid for by DCC Representative. Contractor shall be responsible for the unloading, handling and storage of such products.

1.6 MANUFACTURER'S 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 directly from manufacturers.
- .2 Notify DCC Representative in writing, of conflicts between specifications and manufacturer's instructions, so that DCC Representative may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes DCC 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 DCC 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. DCC Representative reserves the 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 DCC Representative, whose decision is final.

1.8 CO-ORDINATION

- .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 DCC Representative if there is interference. Install as directed by DCC 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 DCC 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 hexagon heads, semi-finished unless otherwise specified. Use No. 304 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, or repaired, as directed by DCC 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 DCC 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 of 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.

END OF SECTION

1.1 SUBMITTALS

- .1 Submit to DCC Representative copies of the following documents, including updates issued:
 - .1 Health and Safety Program as indicated in paragraph 1.9, prior to commencement of work on the work site.
 - .2 Reports or directions issued by authorities having jurisdiction, immediately upon issuance from that authority.
 - .3 Accident or Incident Reports, within 24 hrs of occurrence.
- .2 Submit other data, information and documentation upon request by the DCC Representative as stipulated elsewhere in this section.

1.2 COMPLIANCE REQUIREMENTS

- .1 Comply with the latest edition of the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act.
- .2 Observe and enforce construction safety measures required by:
 - .1 National Building Code of Canada (latest edition).
 - .2 Provincial Worker's Compensation Board.
 - .3 Municipal statutes and ordinances.
- .3 In event of conflict between any provisions of above authorities the most stringent provision shall apply.
- .4 Provide and maintain Worker's Compensation Board coverage for all employees for the duration of the contract. Prior to commencement of the work, at the time of Interim Completion and prior to final payment, provide to the DCC Representative a Certificate of Clearance from the Workers' Compensation Board indicating that the Contractor's account is in good standing.

1.3 RESPONSIBILITY

- .1 The Contractor is responsible for safety of persons and property on the work site and for protection of federal employees and the general public circulating adjacent to work site operations to extent that they may be affected by conduct of work.
- .2 The Contractor is to enforce compliance by workers and other persons granted access to work site with safety requirements of Contract Documents, applicable federal, provincial, and local statutes, regulations, and ordinances, and with the Contractor's Health and Safety Program.
- .3 Should an unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise the DCC Representative verbally and in writing of the hazard or condition.

1.4 SITE CONTROL AND ACCESS

- .1 Control all work site access points and work site activities. Delineate and isolate the work site from adjacent and surrounding areas by use of appropriate means to maintain control of all work site access points.

- .1 A sturdy metal fence of at least 1.8 metres in height shall be constructed between the public way and the project, including any construction trailers and material storage compounds.
- .2 Make provisions for granting permission to access onto work site to all persons who require access. Procedures for granting permission to access are to be in accordance with the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act and the Contractor's Health and Safety Program.
- .3 Ensure persons granted access to the work site are in possession of and wear the minimum personal protective equipment (PPE) designated by the Contractor's Health and Safety Program. Ensure persons granted access to the work site are provided with, trained in the use of, and wear, appropriate PPE that are required above and beyond the designated minimums previously noted and as specifically related to the work site activity that they are involved in. Be responsible for the efficacy of the PPE that is provided above and beyond the designated minimums.
- .4 Erect signage at access points and at other strategic locations around the work site clearly identifying the work site area(s) as being "off-limits" to non-authorized persons. Signage must be professionally made with well understood graphic symbols in both French and English and is not to be used as advertising but for the specific use as related to site safety and key contact information. The size of the signage is expected to be 0.6 metres in height by 1.2m in length to clearly identify the requirements.
 - .1 Information to be provided on the signage is as follows:
 - Project Name/Description:
 - Contractor Company Name:
 - Project Superintendent's Name/Phone No.:
 - DCC Point of Contact Name/Phone No.:
- .5 Secure the work site at all times to protect against un-authorized access.

1.5 FILING OF NOTICE

- .1 File Notice of Project and any other required Notices with the Provincial Authorities prior to commencement of the work. Provide the DCC Representative with a copy of the filed Notice(s) prior to commencement of the work.

1.6 PERMITS

- .1 Obtain permits, licenses and compliance certificates at appropriate times and frequencies as required by the authorities having jurisdiction. Garrison generated permits will be discussed with the DCC Representative, and be obtained by the Contractor.
- .2 Post all permits, licenses and compliance certificates on work site and provide copies to the DCC Representative.

1.7 PROJECT/SITE CONDITIONS

- .1 If any substances encountered are suspected to be Designated Substances, make the area safe and contact the DCC Representative immediately on how to proceed.
- .2 Hazardous materials inventory report is available for inspection from the DCC Representative.

1.8 MEETINGS

- .1 Prior to commencement of work attend a pre-commencement meeting conducted by DCC Representative. Ensure minimum attendance by Contractor's site superintendent. DCC Representative will advise of time, date and location of the meeting and will be responsible for recording and distributing the minutes.
- .2 Conduct site specific occupational health and safety meetings as required by the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act.
- .3 Record and post minutes of all meetings in plain view on the work site. Make copies available to DCC Representative upon request.

1.9 HEALTH AND SAFETY PROGRAM

- .1 Contractors are required under Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act to have in place a Health and Safety Program. Compliance requirements for the content, detail and implementation of the program resides with the provincial authority. For the purpose of this contract the Health and Safety Program shall include a site-specific Health and Safety Plan that acknowledges, assesses and addresses the hazardous substances and/or hazardous conditions known and identified in paragraph 1.7 above, and on-going hazard assessments performed during the progress of work identifying and documenting new or potential health risks and safety hazards not previously known and identified.
- .2 Provide one copy of the Health and Safety Program to the DCC Representative prior to commencement of work on the work site. The copy provided to the DCC Representative is for the purpose of review against the contract requirements related to the known hazardous substances and/or hazardous conditions. The review is not to be construed to imply approval by the DCC Representative that the program is complete, accurate and legislatively compliant with the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act, and shall not relieve the Contractor of their legal obligations under such legislation.

1.10 ACCIDENT REPORTING

- .1 Investigate and report incidents and accidents as required by Ontario Occupational Safety and Health Act, and the Regulations made pursuant to the Act.
- .2 For the purpose of this contract immediately investigate and provide a report to the DCC Representative on incidents and accidents that involve:
 - .1 A resulting injury that may or may not require medical aid but involves lost time at work by the injured person(s).
 - .2 Exposure to toxic chemicals or substances.
 - .3 Property damage.
 - .4 Interruption to adjacent and/or integral infrastructure operations with potential loss implications.
- .3 In the investigation and reporting of incidents and accidents, the Contractor is required to respond in a timely fashion to correct the action that was deemed to have caused the incident and/or accident and advise in writing on the action taken to prevent a re-occurrence of the incident and/or accident.

1.11 RECORDS ON SITE

- .1 Maintain on site a copy of the safety documentation as specified in this section and any other safety related reports and documents issued to or received from the authorities having jurisdiction.
- .2 Upon request, make copies available to the DCC Representative.

1.12 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with DCC Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Field Engineering survey services to measure and stake site.
- .2 Survey services to establish and confirm inverts for Work.
- .3 Recording of subsurface conditions found.

1.2 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practise in Place of Work, acceptable to DCC Representative.

1.3 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to DCC Representative.
- .4 Report to DCC Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.4 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify DCC Representative of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at
- .3 Cut-off points as directed by DCC Representative.
- .4 Where Work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to building occupants, pedestrian and vehicular traffic.
- .5 Where unknown services are encountered, immediately advise DCC Representative and confirm findings in writing.

1.5 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform DCC Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by DCC Representative.

1.6 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

1.7 SUBMITTALS

- .1 Submit name and address of Surveyor to DCC Representative.
- .2 On request of DCC Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify DCC Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should DCC Representative determine that conditions do differ materially, instructions will be issued for changes in the work.

END OF SECTION

Part 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 DCC 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 assure 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 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .8 Restore work with new products in accordance with requirements of Contract Documents.
- .9 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .10 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with "ULC approved" firestopping material, full thickness of the construction element.

- .11 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
- .12 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Final cleaning.

1.2 PROGRESSIVE CLEANING

- .1 Maintain Work site in tidy condition, free from accumulation of waste products and debris.
- .2 Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .3 Remove waste materials from site at regularly scheduled times or dispose of as directed by DCC Representative.
- .4 Provide on-site containers for collection of waste materials and debris. Site plan must be submitted to DCC Representative prior to placement of containers.
- .5 Do not burn waste materials on site.
- .6 Provide and use clearly marked separate bins for recycling.
- .7 The work site must be left clean and tidy upon completion, to the satisfaction of the DCC Representative.
- .8 The Base Landfill Site is not to be used for this project. The Contractor is responsible to make necessary arrangements with a licensed off-site landfill/recycling facility.
- .9 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .10 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .11 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .12 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .13 Schedule cleaning operations 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.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 DCC Representative has established that this project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.

1.2 RELATED REQUIREMENTS

- .1 Section 01 51 00– Temporary Utilities
- .2 Section 01 52 00– Construction Facilities
- .3 Section 02 41 19– Selective Demolition
- .4 Section 02 81 01– Hazardous Materials

1.3 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM E1609 01, Standard Guide for Development and Implementation of a Pollution Prevention Program
- .2 Recycling Certification Institute (RCI):
 - .1 RCI Certification Construction and Demolition Materials Recycling

1.4 DEFINITIONS

- .1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.
- .2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, repair and demolition.
- .3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity or reactivity.
- .4 Non hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.
- .5 Non toxic: Not poisonous to humans either immediately or after a long period of exposure.
- .6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- .7 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- .8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

- .9 Return: To give back reusable items or unused products to vendors for credit.
- .10 Reuse: To reuse a construction waste material in some manner on the project site.
- .11 Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- .12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.
- .13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- .14 Toxic: Poisonous to humans either immediately or after a long period of exposure.
- .15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:
 - .1 Solvents in paints and other coatings;
 - .2 Wood preservatives; strippers and household cleaners;
 - .3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.
 - .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.
- .17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the project, and ensure that requirements of the Construction Waste Management Plan are followed.
- .2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 – Project Meetings before starting any Work of the Contract attended by the DCC Representative, Contractor, and affected Subcontractor's to discuss the Contractor's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.6 SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

1.7 PROJECT CLOSEOUT SUBMISSIONS

- .1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00– Closeout.

1.8 QUALITY ASSURANCE

- .1 Resources for Development of Construction Waste Management Report (CWM Report) :
The following sources may be useful in developing the Draft Construction Waste Management Plan:
 - .1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.
 - .2 Waste-to-Energy Systems: Investigate local waste-to-energy incentives where systems for diverting materials from landfill for reuse or recycling are not available.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the project waste and the available recycling and reuse programs in the project area.
- .2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:
 - .1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
 - .2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.
- .3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 (CWM PLAN) IMPLEMENTATION

- .1 Manager: Contractor is responsible for designating an on site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the project.
- .2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each Subcontractor, DCC Representative and other site personnel as required to maintain CWM Plan.
- .3 Instruction: Provide on site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the project to Subcontractor's at appropriate stages of the project.

- .4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:
- .1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
 - .2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.

3.2 SUBCONTRACTOR'S RESPONSIBILITY

- .1 Subcontractor's shall cooperate fully with the Contractor to implement the CWM Plan.

3.3 SAMPLE CONSTRUCTION WASTE MANAGEMENT FORMS

- .1 Sample waste tracking form below can be used by the Contractor to establish their own forms for recording management of construction waste:
- .2 SAMPLE WASTE MANAGEMENT FORM.

Material Stream	Diverted Waste by Report Date	Total	Units				
Sept	Oct	Nov	Dec				
Material Streams Contributing to Credit	Plastic	1.25	2.5	10	5	18.75	m ³
Carpet	2.5	2.5	2.5	0	7.5	m ³	
Paper/Cardboard	5	2.5	2.5	5	15	m ³	
Clean Wood	0	25	0	1.25	26.25	m ³	
Metal	1.25	2.5	5.5	7	16.25	m ³	
Gypsum Board	2.5	2.5	4	5	14	m ³	
Brick/Concrete	10.5	2.5	5.5	8.75	27.25	m ³	
Asphalt Shingles	10	0	0	0	10	m ³	
Total Diverted Waste	135	m ³					
Material Streams not Contributing to Credit	Landfill	10.75	7.5	15	10	43.25	m ³
Screen Fines (ADC)	5	1.25	0	2.5	8.75	m ³	
150 mm Minus (ADC)	1.25	1.25	5	5.5	13	m ³	

Total Landfill/ADC Waste	65			m ³					
Total Waste	200	m ³							
Percent Diverted	67.5	%							

END OF SECTION

Part 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.

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 the scheduled commissioning activities, submit 2 copies of the DRAFT Operating and Maintenance Manuals, for DCC Representatives review and use during the commissioning activities. After the completion of the commissioning activities, the DCC Representative will return to the Contractor 1 DRAFT copy, with review comments, for revision. Submit 1 copy of the revised Operating and Maintenance 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:
 - .1 Two (2) hard copies of the FINAL Operating and Maintenance Manuals.
 - .2 One (1) electronic copy (USB only) of the FINAL Operating and Maintenance Manual in PDF format. Files on USB shall be organized in same manner as the hard copies, and must follow the same formatting and sequence as specified in article 1.3 and 1.4 of this section.
- .3 Building will not be deemed ready for use, and the Final Certificate of Completion will not be granted, unless the Operating and Maintenance Manuals and the "As-built" Record Documents have been submitted and reviewed and accepted by the DCC Representative.
- .4 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.
- .5 If requested, furnish evidence as to type, source and quality of products provided.
- .6 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .7 Pay costs of transportation.

1.3 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by 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, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions 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 DCC 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 DCC Representative.

1.6 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of opaque drawings, provided by DCC 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 locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .2 Field changes of dimension and detail.
 - .3 Changes made by change orders.
 - .4 Details not on original Contract Drawings.
 - .5 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, produce electronic "as-built" records on disk using AutoCad 2011 Suite. Annotate "AS-BUILT RECORD" in each drawing title block.
 - .2 Electronic "as-built" drawings shall be in accordance with all DND drawing standards. Copy of drawing standards can be obtained from the DCC Representative.
 - .3 All changes shall be shown on a separate drawing layer named "as-built".
 - .4 At least 2 weeks prior to scheduled commissioning activities, submit one copy of the DRAFT "As-built" Project Record Documents for DCC Representatives review and use during the commissioning activities. After the completion of the commissioning activities, the DCC 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 and disk of "as-built" record drawings.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with Engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 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 trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .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 and 01 91 00 - Commissioning.
- .15 Additional requirements: As specified in individual specification sections.

1.8 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.

1.9 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 DCC Representative prior to the Contractor's submission for Interim Certificate of Completion.
- .4 Receive and catalogue all items. Submit inventory listing to DCC Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Maintenance materials are to be delivered to the DCC Representative prior to the Contractor's submission for Interim Certificate of Completion.
- .4 Receive and catalogue all items. Submit inventory listing to DCC Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.11 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 DCC Representative prior to the Contractor's submission for Interim Certificate of Completion.
- .4 Receive and catalogue all items. Submit inventory listing to DCC Representative. Include approved listings in Maintenance Manual.

1.12 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 DCC Representative.

1.13 WARRANTIES AND GUARANTEES

- .1 Separate each warranty or guarantee 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 guarantees, 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 DCC Representative's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and guarantees until time specified for submittal.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of equipment and systems to DND's personnel.

1.2 DESCRIPTION

- .1 Demonstrate operation and maintenance of equipment and systems to DND's personnel two weeks prior to date of substantial performance.
- .2 DCC Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct DND's personnel, and provide written report that demonstration and instructions 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 DCC 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 91 00 - Commissioning 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 instructions comply with requirements.
- .2 Verify that designated personnel are present.
- .3 Ensure equipment has been inspected and put into operation.
- .4 Ensure testing, adjusting, and balancing has been completed and equipment and systems are fully operational.

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 Mechanical Specifications – Mechanical Systems: Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at DND/RP Ops PM's choice), of DND/RP Ops PM's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.
 - .2 25 01 12 – Automatic Controls and Instrumentation: Training: duration to meet the minimum quantity of training and duration as outlined within Article 1.9 of this section.
 - .3 Electrical Specifications - Electrical System: 8 hour of instruction.

1.9 MECHANICAL SYSTEMS TRAINING

- .1 Turnover Seminar:
 - .1 Organize and conduct a seminar to instruct DND and their representatives in the operation and general preventative maintenance of equipment and systems provided at the completion of the project.
 - .2 Provide services of qualified personnel, including each sub-trade, each major equipment supplier and design DCC Representative to attend seminar and instruct on his equipment or system. Chaired and conduct seminar in collaboration with the documentation agent.
 - .3 At seminar, submit final copies of record drawings and operating and maintenance manuals to DCC Representative.
- .2 Systems Seminar:
 - .1 Allow a minimum of four (4) days to conduct the systems training seminar for DND and their representative to address the following topics:
 - .1 Air Systems:
 - .1 Review operation of systems and equipment:
 - make-up air units
 - paint spray booth
 - all exhaust systems
 - .2 Review equipment maintenance
 - .3 Air system site tour (paint spray booth/ fans/make up air units)
 - demonstrate start/stop
 - components
 - maintenance
 - .2 Heating System
 - .1 Heating systems

- .2 Review operation of system and equipment
- .3 Review equipment maintenance
- .4 Heating system site tour
- .5 Hot water heaters
- .6 Water softener
- .3 Pumping System
 - .1 Review system operation and equipment
 - .2 Review equipment maintenance
- .4 Site Tour Pumps
 - .1 Demonstrate pumping system
 - .2 Pump maintenance
- .5 Fire Protection
 - .1 Fire protection
 - .2 Review system operation and equipment
 - .3 Review equipment maintenance
 - .4 Sprinkler tree and components
 - .5 Location of flow switches/siamese connections
 - .6 Backflow preventors
- .6 Plumbing
 - .1 Review system operation equipment
- .7 Site Services
 - .1 Sanitary /domestic water
- .2 HVAC Control Seminar: refer to Section 25 01 12 – Automatic Controls and Instrumentation: Training.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Includes general requirements for commissioning facilities and facility systems.

1.2 QUALITY ASSURANCE

- .1 Provide testing organization services under provisions specified in Section 01 45 00 - Quality Control.
- .2 Testing organization: current member in good standing of AABC certified to perform specified services.
- .3 Comply with applicable procedures and standards of the certification sponsoring association.
- .4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.3 REFERENCES

- .1 Associated Air Balance Council (AABC): National Standards For Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronic Systems.

1.4 METHODOLOGY

- .1 Verification of performance of building systems will be performed by means of a commissioning process.
- .2 Commissioning plan and testing activities shall be performed by Contractor and witnessed by Commissioning Agent.
- .3 Retain an independent Cx Agent for this facility to conduct all activities outlined within this section and related technical sections. Interface, cooperate and coordinate with DCC Representative. Submit copies of submittals such as shop drawings/product data sheets, schedules, O&M manuals, and test reports to DCC Representative as required.
- .4 Contractor shall prepare and submit a completed commissioning plan and schedule for approval by Commissioning Agent.
- .5 Contractor's commissioning plan shall be submitted 12 weeks after award of contract.

1.5 COMMISSIONING OBJECTIVES

- .1 To bring mechanical, electrical and building architectural systems and components from a state of static completion to a state of dynamic operation.
- .2 To verify conformance to contract requirements.
- .3 To confirm installations meet requirements of performance specification and design intent of contract drawings and specifications.
- .4 To provide all testing documents and records.
- .5 To ensure completed facility meets user stated requirements.
- .6 To provide a documented operator training program.

- .7 To verify accuracy of project record drawings and operating and maintenance manuals.

1.6 CONTRACTOR'S COMMISSIONING PLAN

- .1 Provide a commissioning plan consisting of:
 - .1 Details regarding roles and responsibilities during all phases of commissioning
 - .2 Documentation defining design assumptions and performance standards of proposed systems
 - .3 Description of systems, intended operation and performance details
 - .4 Static testing and verification procedures
 - .5 Performance testing procedures
 - .6 Contractors and manufacturers start-up reports
 - .7 Check sheet documentation for recording testing procedures and recording test results prepared by the Contractor for mechanical, electrical and building architectural systems and components
 - .8 Seasonal or deferred commissioning
 - .9 Training plan for building operators and
 - .10 Final commissioning report.
- .2 To consist of four sections, described as follows:
 - .1 Part 1: commissioning activities directed by commissioning agent and carried out by contractor.
 - .2 Part 2: descriptions of building mechanical and electrical systems as they appear in building manual prepared under Section 01 78 00 – Closeout Submittals.
 - .3 Part 3: testing procedures and documentation of test results prepared by contractor for mechanical, electrical and building architectural components.
 - .4 Part 4: test procedures and documentation of seasonal commissioning.

1.7 COMMISSIONING AGENT'S RESPONSIBILITIES

- .1 For ensuring that commissioning activities are carried out in accordance with the Contractor's Commissioning Plan.
- .2 Commissioning agent will:
 - .1 Assemble commissioning team and ensure coordination of activities with team in carrying out the Contractor's Commissioning Plan.
 - .2 Chair and arrange commissioning meetings.
 - .3 Witness all equipment start-up and collect all manufacturer's start-up reports.
 - .4 Witness testing and balancing measurements and procedures.
 - .5 Witness all tests and initial all test documents at time of test.
 - .6 Co-sign off, as witness, all systems verification and test forms.
 - .7 Coordinate building operators training.

- .8 Arrange for provision of additional training were required.
- .9 Turn over completed interim and final commissioning reports to DCC Representative.

1.8 CONTRACTOR'S SUBMITTALS

- .1 Prior to start of Work, submit name of organization and Contractor personnel proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.
- .2 Submit documentation to confirm organization or personnel compliance with quality assurance provision.
- .3 Submit digital copies of each of report forms proposed for use.
- .4 Contractor shall prepare & submit a completed Commissioning Plan and Commissioning Schedule for review by the Commissioning Agent eight (8) weeks after award.
- .5 Submit an updated Commissioning Schedule as directed by the Commissioning Agent.
- .6 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 3 copies of the FINAL commissioning report in D-ring binders, complete with index tabs.
- .7 Submit reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.9 PROCEDURES - GENERAL

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Notify DCC Representative 14 days prior to beginning of operations.
- .3 Accurately record data for each step on check sheets prepared by the Contractor.
- .4 Report to DCC Representative any deficiencies or defects noted during performance of services.

1.10 FINAL REPORTS

- .1 Organization having managerial responsibility shall make reports.
- .2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

1.11 CONTRACTOR'S RESPONSIBILITIES

- .1 Prepare each system for testing and balancing.
- .2 Cooperate fully with commissioning agent in execution of commissioning plan. At completion of commissioning, provide a written statement affirming that building systems are operating properly in accordance with requirements of performance specification and design intent of contract drawings and specifications.

- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .4 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

1.12 CONTRACTOR'S PREPARATION

- .1 Provide instruments required for testing, adjusting, and balancing operations.
- .2 Make instruments available to DCC Representative to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.
- .5 Verify lighting is turned on when lighting is included in cooling load.
- .6 Verify equipment such as computers, laboratory and electronic equipment are in full operation.
- .7 A commissioning plan and commissioning schedule.
- .8 All testing procedures and data recording forms (examples of acceptable documents will be provided by DCC Representative)
- .9 Schematics and flow diagrams necessary for commissioning.
- .10 Start-up reports.
- .11 An interim commissioning report which contains all required commissioning information except for that remaining to be done as seasonal or deferred commissioning work.
- .12 Seasonal commissioning requirements.
- .13 Submit final commissioning report to commissioning agent.

1.13 BUILDING SYSTEMS TO BE COMMISSIONED

- .1 The Contractor shall provide commissioning services for:
 - .1 All mechanical systems and components.
 - .1 Test, adjust and operate the following systems and components after start-up but before functional performance testing, to confirm operations are in accordance with requirements of Contract Documents.
 - .1 HVAC systems and components, including MAUs, EFs and paint spray booth, etc.
 - .2 Pump, and
 - .3 Hot water heater
 - .2 Verify modes and sequences of control and monitoring, interlocks, and responses to emergency conditions.
 - .2 All electrical distribution, communication, security and lighting systems.
 - .1 Independent testing shall be carried out for high voltage distribution and load balance.

- .3 Building architectural shall include sign-off tests for all electrically activated door hardware.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes the following:
 - .1 Demolition and removal of selected portions of exterior and interior building components and finishes.
 - .2 Repair procedures for selective demolition operations.
- .2 This section does not include the following:
 - .1 Removal of hazardous materials or asbestos abatement.
 - .2 Demolition of exterior building components or structural elements.
 - .3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.

1.2 RELATED REQUIREMENTS

- .1 Section 01 35 43 – Environmental Procedures
- .2 Section 07 01 45 - Metal Roofing Repairs

1.3 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A10.8 2011, Safety Requirements for Scaffolding
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM C475/C475M-15, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
- .3 CSA Group (CSA)
 - .1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 2012
 - .2 Canadian Environmental Protection Act (CEPA), 2012
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34
 - .4 Motor Vehicle Safety Act (MVSA), 1995
 - .5 Hazardous Materials Information Review Act, 1985
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 241 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.4 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to the DCC Representative.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.
- .5 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .6 Draft Construction Waste Management Plan (Draft CWM Plan): Detailed inventory of materials in building indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Section 01 35 43 - Environmental Procedures and as follows:
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
- .7 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate with DCC Representative for the material ownership as follows:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain DCC Representative's property, demolished materials shall become Contractor's property and shall be removed from Project site.
 - .2 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.
- .2 Pre Demolition Meeting: Convene pre-installation meeting 1 week prior to beginning work of this Section with DCC Representative in accordance with Section 01 31 00 Project Management and Coordination to:
 - .1 Confirm extent of salvaged and demolished materials
 - .2 Review demolition plan
 - .1 Verify existing site conditions adjacent to demolition work
 - .2 Coordination with other construction sub trades
- .3 Hold project meetings every other week.

- .4 Ensure project manager, key personnel, subcontractor representatives, site supervisor attend.
- .5 WMC must provide verbal report on status of waste diversion activity at each meeting.
- .6 DCC Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.6 ACTION AND INFORMATION SUBMITTALS

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Schedule of Selective Demolition Activities: Coordinate with DCC Representative, and indicate the following:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - .2 Coordinate with DCC Representative's ongoing site operations and limit the number of interruptions during regular business hours.
 - .3 Interruption of utility services.
 - .4 Coordination for shutoff, capping, and continuation of utility services.
 - .5 Use of elevator and stairs.
 - .6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
 - .7 Coordinate with DCC Representative, continuing occupancy of portions of existing building.
 - .2 Demolition Plan: Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:
 - .1 Proposed Noise Control & Dust Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. DCC Representative reserves the right to make modifications where proposed methods interfere with the DCC Representative's ongoing operation
 - .2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.
 - .3 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - .4 Pre demolition Photographs: Submit photographs indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.

1.7 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:

- .1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.
- .2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.
- .2 Qualifications: Provide proof of qualifications when requested by DCC Representative:
 - .1 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:
 - .1 Conform to the National Occupational Health and Safety Act and Regulations.
 - .2 Conform to Workers' Compensation Board Regulations.
 - .3 Conform to local municipal bylaws and regulations governing this type of work.

1.8 SITE CONDITIONS

- .1 Maintain access to existing means of egress, walkways, corridors, exits, and other adjacent occupied or used facilities:
 - .1 Do not close or obstruct means of egress, walkways, corridors, exits, or other occupied or used facilities without written acceptance from authorities having jurisdiction.
- .2 The DCC Representative assumes no responsibility for condition of areas to be selectively demolished:
 - .1 Conditions existing at time of Award will be maintained by DCC Representative as far as practical.
- .3 Discovery of Hazardous Substances: Based on the third part Hazardous Substance Report, Hazardous Substances may be encountered in the Work based on the limiting sampling and results, refer to report in appendix. Immediately notify DCC Representative if materials suspected of containing hazardous substances are encountered and perform the following activities:
 - .1 Take all necessary precautions to protect workers and public safety until materials are confirmed to be non-hazardous, Refer to 01 70 12 - Safety Requirements.
 - .2 Hazardous materials will be removed by DCC Representative before start of the Work.
 - .3 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify DCC Representative. Hazardous materials will be removed by DCC Representative under a separate contract or as a change to the Work.

Part 2 Products

2.1 TEMPORARY SUPPORT STRUCTURES

- .1 Design temporary support structures required for demolition work and underpinning and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in province of the Work.

2.2 DESCRIPTION

- .1 This section of the Work includes, but is not necessarily limited to, the following:
 - .1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris
 - .2 Selective demolition of exterior wall and roof assemblies to accommodate new doors and penetrations for mechanical and electrical equipment.
 - .3 Selective demolition to allow new walls, bulkheads, ceilings and other materials to meet existing construction as indicated
 - .4 All material from demolition shall be removed from site immediately with no salvage, selling, sorting or burning permitted on site
 - .5 Retain items indicated on drawings for re use in new construction

2.3 DEBRIS

- .1 Make all arrangements for transport and disposal of all demolished materials from the site.

2.4 EQUIPMENT

- .1 Provide all equipment required for safe and proper demolition of the building interiors indicated.

2.5 REPAIR MATERIALS

- .1 Use repair materials identical to existing materials:
 - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - .2 Use a material whose installed performance equals or surpasses that of existing material.
 - .3 Comply with material and installation requirements specified in individual Specification Sections.
- .2 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes; gypsum based products are not acceptable for work of this Section.
- .3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.
- .4 Prefinished Sheet Steel: Prefinished sheet steel, colour to match existing radiation cabinets, bent and profiled to match existing radiation cabinets.
- .5 Gypsum Board Patching Compounds: Joint compound to ASTM C475/C475M, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes.
- .6 Roofing Materials: As indicated in Section 07 01 45 - Metal Roofing Repairs.

2.6 EXISTING MATERIALS

- .1 Items to be retained for re-use in new construction include, but are not limited to the following:
 - .1 Confirm with DCC Representative any materials that appear to be in reusable condition prior to disposal.
 - .2 Confirm with DCC Representative any materials scheduled for re use that are not in reusable condition prior to installation.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that utilities have been disconnected and capped.
- .2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .4 Notify the DCC Representative where existing mechanical, electrical, or structural elements conflict with intended function or design:
 - .1 Investigate and measure the nature and extent of conflict and submit a written report to DCC Representative.
 - .2 DCC Representative will issue additional instructions or revise drawings as required to correct conflict.
- .5 Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- .1 Coordinate existing services indicated to remain and protect them against damage during selective demolition.
- .2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - .1 Arrange to shut off affected utilities with utility companies.
 - .2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - .4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound. Patch concrete using cementitious grout.
- .3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.

- .4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- .1 Identify and mark all equipment and materials identified to be retained by DCC Representative or to be re-used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.
- .2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.
- .3 Confirm that all electrical and telephone service lines entering buildings are not disconnected.
- .4 Do not disrupt active or energized utilities crossing the demolition site.
- .5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.
- .6 Mark all materials required to be re used, store in a safe place until ready for re installation.
- .7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.
- .8 Remove permanent marker lines used or found on exposed surfaces and at surfaces indicated for subsequent finish materials. Mechanically remove permanent marker lines and associated substrates where permanent marker lines occur and patch surface. Sealing or priming over permanent marker lines is not acceptable.

3.4 CONCRETE SLAB REINFORCING

- .1 Mark location of reinforcing steel in concrete slabs prior to cutting or coring using non-destructive, non-ionizing radio frequency locators.
- .2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with DCC Representative where slab features interfere with core drilling.
- .3 Notify the DCC Representative immediately for further instructions where coring or cutting will damage existing slab features.

3.5 SELECTIVE DEMOLITION

- .1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.
- .2 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.
- .3 Demolish in a manner to minimize dusting and to prevent migration of dust.
- .4 Selling or burning of materials on the site is not permitted.
- .5 Remove concrete bases by cutting and chipping, take precautions against slab cracking and degradation. Grind edges smooth, fill and make level with self-levelling grout.

- .6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.
 - .1 Provide bond beams in new openings cut into existing concrete masonry unit walls.
 - .2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.
- .7 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.
- .8 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.
- .9 Patch and repair all radiation cabinets, mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.6 PATCHING AND REPAIRING

- .1 Floors and Walls:
 - .1 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
 - .2 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .3 Patch with durable seams that are as invisible as possible.
 - .4 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - .5 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - .6 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- .2 Roofing: As indicated in Section 07 01 45 - Metal Roofing Repairs.

3.7 PROTECTION

- .1 Prevent debris from blocking drainage inlets and systems and ground draining, and protect material and electrical systems and services that must remain in operation.
- .2 Arrange demolition and shoring work so that interference with the use of adjoining areas by the DCC Representative and users is minimized.
- .3 Maintain safe access to and egress from occupied areas adjoining.
- .4 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.8 CLEANING

- .1 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21– Construction Demolition Waste Management and Disposal.

- .2 Waste Management: Separate waste materials for reuse and/or recycling in accordance with Section 01 74 21- Construction Demolition Waste Management and Disposal, and as follows:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .3 Divert excess materials from landfill to site approved DCC Representative.
- .4 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.
- .5 Maintain access to exits clean and free of obstruction during removal of debris.
- .6 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights of way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.
- .7 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal facilities must be those approved of and listed in CWM Plan.
 - .2 Written authorization from DCC Representative is required to deviate from disposal facilities listed in CWM Plan.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Environmental Protection Act, 1999 (CEPA 1999).
 - .1 Export and Import of Hazardous Waste Regulations (SOR/2002-300).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Fire Code of Canada 2005.
- .4 Transportation of Dangerous Goods Act (TDG Act) 1999, (c. 34).
- .5 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

1.2 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit to DCC Representative current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.
 - .2 Submit hazardous materials management plan to DCC Representative that identifies hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Co-ordinate storage of hazardous materials with DCC Representative and abide by internal requirements for labelling and storage of materials and wastes.
- .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
- .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.
- .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the DCC Representative.
- .5 Transfer of flammable and combustible liquids is prohibited within buildings.
- .6 Do not transfer flammable and combustible liquids in vicinity of open flames or heat-producing devices.
- .7 Do not use flammable liquids having flash point below 38 degrees C, such as naphtha or gasoline as solvents or cleaning agents.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are not mixed.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

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

1.5 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.
- .3 If hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with DCC Representative.
 - .2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to DCC Representative.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to DCC Representative.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to DCC Representative and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on site quantity of hazardous materials required to perform work.
- .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
- .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
- .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
- .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
- .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 30 00 – Cast-In-Place Concrete.

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Chemical grout use will be factored into concrete works.
 - .2 Supply and installation as per manufacturer's instructions/recommendations.
- .2 New work shall be in accordance with agreement that would be established (when work is required) between DCC Representative and Contractor.

1.3 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C109/C109M-20a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. (50-mm) Cube Specimens).
 - .2 ASTM C496/C496M-17 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - .3 ASTM C 881/C881M-20a, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheet (SDS)

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Site Visit: Schedule a site visit with DCC Representative to examine existing site conditions and to verify cracks conditions and surface repairs work as required before work starts.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for grouting compounds and include product characteristics, performance criteria, physical properties, finish, and limitations.
 - .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures

1.6 QUALITY ASSURANCE

- .1 Manufacturer s Instructions: submit manufacturer s application instructions and special handling criteria, cleaning procedures and
- .2 Provide inspection reports for review by DCC Representative and do not proceed without written approval when deviations from mix design or parameters are found.
 - .1 Submit in accordance with Section 01 45 00 – Quality Control.

1.7 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain uniform minimum temperature of 15 degrees C and humidity of 20% to 40% before and during application as well as after completion.
 - .2 Temperature of concrete being bonded must be 7 degrees C and to be maintained at this temperature for 24 hours during curing of epoxy.
 - .3 Use epoxy injection system only for well-ventillated areas.

Part 2 Products

2.1 MATERIALS

- .1 Epoxy grout: two component, ICC-ES approved, chemical adhesive, mixed at gun nozzle, that is compatible with dry, saturated, cracked, or uncracked concrete.
- .2 Epoxy injection system: two-component, modified epoxy resin and modified amine curing agent pumped and mixed at gun nozzle, 40 MPa compressive strength, elongation 4%, flexural strength 50 MPa.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain DCC Representative's written approval before using product.
 - .1 Provide 24 hours minimum notice prior to grouting.
- .2 Protect previous Work from staining.
- .3 Clean and remove stains prior to application for concrete finishes.
- .4 Contractor shall clean cracks and make sure they are free of rust, sand and debris.
 - .1 Injection is not recommended where steel has already begun expanding due to corrosion.
 - .2 Contractor shall assess the condition inside the crack, and take cores where cracks are dirty and structural repair is desired rather than a sealing operation.
- .5 Clean cracks and fractures to receive epoxy resin with pressure water jet or compressed air.

- .1 Do not use where cracks are filled with water. Cracks should be dry for maximum bond.
- .6 Drill crack (where applicable) for injection ports or T-fittings.
- .7 Apply crack sealer over front surface of crack and allow it to dry sufficiently before injection of epoxy in accordance with manufacturer's instructions.
- .8 In locations where new concrete dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .9 Do not place load upon new concrete until authorized by DCC Representative.

3.2 INSTALLATION/APPLICATION

- .1 Do work as per manufacturer's instructions.

3.3 SURFACE REPAIRS

- .1 Rebuild surface profile and fill with material to match adjacent construction.
- .2 Install repair material in accordance with manufacturer s instructions.

3.4 INSPECTION

- .1 DCC Representative will inspect work for
 - .1 Adherence to specific procedures and materials.
 - .2 Final cleanliness and completion.
 - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11- Cleaning.
- .2 Leave work area clean at end of each working day.
- .3 Divert unused grouting compounds from landfill to official hazardous material collections site as approved by DCC Representative.
- .4 Do not dispose of unused grouting compounds and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
- .5 Prevent grouting compounds and additive materials from entering drinking water supplies or streams.
- .6 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.
- .7 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.6 PROTECTION OF COMPLETED WORK

- .1 Protect adjacent finished work against damage which may be caused by ongoing work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 20 00 – Concrete Reinforcing
- .2 Section 03 30 00 – Cast-In-Place Concrete
- .3 Section 03 35 00 – Concrete Finishing

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA-A23.1-19 /A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-O86-19, Engineering Design in Wood.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA O153-19, Poplar Plywood.
 - .6 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
 - .7 CSA S269.1-16 (R2021), Falsework and Formwork.
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: Convene pre-installation meeting as directed by DCC representative prior to beginning concrete works.
 - .1 Ensure site supervisor, DCC Representative, attend.
 - .1 Verify project requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in formwork liners and coatings and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 43 – Environmental Procedures to DCC Representative.

1.5 QUALITY ASSURANCE

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

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 off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from damages.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 Use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA O437 Series.
 - .2 Rigid insulation board: to CAN/ULC-S701.
- .2 Form ties:
 - .1 Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes minimum 25 mm diameter in concrete surface.
- .3 Form liner:
 - .1 Plywood: high or medium density overlay Canadian Softwood Plywood to CSA O151
- .4 Form release agent: Proprietary, non-volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non petroleum containing, non-toxic, biodegradable, low VOC.
- .5 Falsework materials: to CSA-S269.1.
- .6 Sealant: to Section 07 92 10- Joint Sealants.

Part 3 Execution

3.1 FABRICATION AND ERECTION

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

- .2 Obtain DCC Representative approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 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.
- .9 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .10 Use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners, joints, unless specified otherwise.
- .11 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.
 - .2 Ensure lining is new and not reused material.
 - .3 Ensure lining is dry and free of oil when concrete is poured.
 - .4 Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - .5 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
 - .6 Cost of textile lining is included in price of concrete for corresponding portion of Work.
- .12 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Remove formwork when concrete has reached 70 % of its 28 day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .2 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 30 00 – Cast-In-Place Concrete
- .3 Section 03 35 00 – Concrete Finishing

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 No measurement made under this Section.
 - .1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

1.3 REFERENCE STANDARDS

- .1 American Concrete Institute (ACI)
 - .1 ASTM A 1064/A 1064M-22, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .2 CSA Group
 - .1 CSA-A23.1-19 /A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-19, Design of Concrete Structures.
 - .3 CSA-G30.18-09 (R2019), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2020, Reinforcing Steel Manual of Standard Practice.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: Convene pre-installation meeting as directed by DCC representative prior to beginning concrete works.
 - .1 Ensure site supervisor, DCC Representative attend.
 - .1 Verify project requirements.

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 proprietary materials used in Cast-In-Place Concrete and additives and include

product characteristics, performance criteria, physical size, finish, and limitations.

- .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 43 – Environmental Procedures to DCC representative.
- .3 Quality Assurance Submittals:
 - .1 Submit in accordance with Section 01 45 00 - Quality Control. and as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Mill Test Report: upon request, submit to DCC Representative certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.
 - .3 Upon request submit in writing to DCC Representative proposed source of reinforcement material.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions 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 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by DCC Representative.
- .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 1064/A 1064M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM 1064/A 1064M.
- .6 Welded steel wire fabric:
 - .1 Deformed in accordance ASTM A 1064/A 1064M, fabricated from as drawn steel wire into flat sheets; sizes as indicated on Drawings.
- .7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .8 Tie wire: 1.5 mm diameter annealed wire.
- .9 Mechanical splices: subject to approval of DCC Representative.

- .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, CSA-A23.1/A23.2.
- .2 Obtain DCC Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide DCC Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.
- .2 Upon request inform DCC Representative of proposed source of supplied material.

Part 3 Execution

3.1 PREPARATION

3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by DCC Representative.
- .2 When field bending authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

- .1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.
- .2 Place reinforcing steel in accordance with CSA-A23.1/A23.2.
- .3 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 Apply thick even film of mineral lubricating grease when paint is dry.
- .4 Prior to placing concrete, obtain DCC Representative's approval of reinforcing material and placement.
- .5 Maintain cover to reinforcement during concrete pour.

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 Reinforcing steel and welded wire fabric.
- .2 Inspection and testing of reinforcing and reinforcing materials carried out by testing laboratory designated by DCC Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory certified to CSA A283.
- .3 Ensure test results distributed for discussion at pre-pouring concrete meeting between testing laboratory and DCC Representative.
- .4 DCC Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .5 Inspection or testing by DCC Representative not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 35 00 – Concrete Finishing

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Measure cast-in-place concrete in cubic metres calculated from neat dimensions authorized in writing by DCC Representative.
 - .1 Concrete placed beyond dimensions indicated not measured.
 - .2 No deductions made for volume of concrete displaced by reinforcing steel, or structural steel.
 - .3 No deductions made for volume of concrete less than 0.1 m² in cross sectional area displaced by individual drainage openings.
 - .4 Supply and installation of anchor bolts, nuts and washers and bolt grouting not measured but considered incidental to work.

1.3 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C 881/C881M-20a, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - .5 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM C C1059/C1059M-21, Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
 - .7 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .8 ASTM D624-2012, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .2 British Standards Institution (BSI Group):

- .1 EN 15804:2012, Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 CSA Group
 - .1 CSA A23.1:19 /A23.2:19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283:19, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-19, Cementitious Materials Compendium.
- .5 International Organization for Standardization (ISO):
 - .1 ISO 14025:2006, Environmental labels and declarations — Type III environmental declarations — Principles and procedures
 - .2 ISO 14040:2006, Environmental management — Life cycle assessment — Principles and framework
 - .3 ISO 14044:2006, Environmental management — Life cycle assessment — Requirements and guidelines
 - .4 ISO 21930:2017, Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services

1.4 DEFINITIONS

- .1 Environmental Product Declaration (EPD): Third-party verified documentation with the supporting Product Category Rule (PCR) and Life cycle assessment information. Prepared in accordance with ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 - .1 Industry-wide (generic) EPD with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator. For the purposes of this project, the Industry-Wide EPD shall be the RMCAO Industry-Wide EPD for Ready-Mixed Concrete issued July 27, 2022 (EPD 351).
 - .2 Product-specific Type III EPD with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator.
- .2 Supplementary Cementitious Materials (SCM)s: Materials added to concrete which contribute to the properties of hardened concrete through hydraulic or pozzolanic activity.
- .3 Workability: This term broadly describes the total properties and expectations for concrete delivered to site as follows:
 - .1 Individual tested properties of concrete that account for confined or free flow slump, penetration, compaction, or relative plasticity of various concrete mix designs used for the project.

- .2 Overall properties involved with mixing, handling, transportation, and placement using vibratory compaction methods without loss of homogeneity of in-place concrete.

1.5 ABBREVIATIONS AND ACRONYMS

- .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement types:
 - .1 GU, GUb and GUL - General use cement.
 - .2 MS and MSb - Moderate sulphate-resistant cement.
 - .3 MH, MHb and MHL - Moderate heat of hydration cement.
 - .4 HE, HEb and HEL - High early-strength cement.
 - .5 LH, LHb and LHL - Low heat of hydration cement.
 - .6 HS and HSb - High sulphate-resistant cement.
- .2 Fly ash types:
 - .1 F - with CaO content maximum 8%.
 - .2 CI - with CaO content 15 to 20%.
 - .3 CH - with CaO minimum 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: Convene pre-installation meeting as directed by DCC representative prior to beginning concrete works.
 - .1 Ensure site supervisor, DCC Representative, speciality contractor - finishing, attend.
 - .1 Verify project requirements.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures
- .3 Site Quality Control Submittals:
 - .1 Provide testing inspection results reports for review by DCC Representative and do not proceed without written approval when deviations from mix design or parameters found.
 - .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 and concrete delivery tickets for each truck (including but not limited to: plant, truck, concrete mix and volume information).

- .3 Concrete hauling time: provide for review by DCC Representative deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.
- .4 Sustainable Design Submittals: Submit in accordance with Section 01 35 43 – Environmental Procedures.
 - .1 Provide low carbon concrete in accordance with the Industry-Wide EPD Approach **OR** the Product-Specific EPD Approach below. Where available, the Product-Specific EPD Approach is preferred.
 - .2 Industry-Wide EPD Approach: 90% by volume of each mix design to include a 20% reduction in Global Warming Potential (GWP) compared to the Baseline Mix with the associated 28-day compressive strength and cement type in accordance with the RMCAO Industry-Wide EPD for Ready-Mixed Concrete (2022).
 - .3 Product-Specific EPD Approach: Submit a product specific EPD for 90% by volume of each mix design demonstrating a 20% reduction in Global Warming Potential (GWP) compared to the Baseline Mix with the associated 28-day compressive strength and cement type in accordance with the RMCAO Industry-Wide EPD for Ready-Mixed Concrete (2022).
- .5 Submit mix designs a minimum of 4 weeks before starting concrete work.
- .6 Indicate the total volume of concrete used for each mix design as part of the record drawing submission package prior to Substantial Completion.

1.8 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00- Quality Control.
- .2 Provide DCC Representative, minimum 2 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 meet specified requirements.
- .3 At least 2 weeks prior to beginning Work, inform DCC Representative of source of fly ash.
 - .1 Changing source of fly ash without written approval of DCC Representative is prohibited.
- .4 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by DCC Representative on following items:
 - .1 Hot weather concrete.
 - .2 Cold weather concrete.
 - .3 Curing.

- .4 Finishes.
- .5 Quality Control Plan: provide written report to DCC Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
- .2 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Modifying maximum time limit without receipt of prior written agreement from DCC Representative and concrete producer as described in CSA A23.1/A23.2. is prohibited.
 - .2 Deviations submitted for review by DCC Representative.
 - .3 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.10 SITE CONDITIONS

- .1 Placing concrete during rain or weather events that could damage concrete is prohibited.
- .2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.
- .3 Cold weather protection:
 - .1 Maintain protection equipment, in readiness on Site.
 - .2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.
 - .3 Placing concrete upon or against surface at temperature below 5°C is prohibited.
- .4 Hot weather protection:
 - .1 Protect concrete from direct sunlight when ambient temperature above 27°C.
 - .2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.
- .5 Protect from drying.

Part 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 DCC Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

- .1 Portland Cement: GU.
- .2 Supplementary cementing materials: with minimum 20% by mass of total cementitious materials to CSA A3001.
- .3 Water: to CSA A23.1.
- .4 Aggregates: to CSA A23.1/A23.2.
- .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494, ASTM C1017. DCC Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Dampproof membrane:
 - .1 Membrane adhesive: as recommended by membrane manufacturer.

2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet DCC Representative 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 the requirements specified in the drawings.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain DCC Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00- Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitate placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete permitted only after approval of equipment and mix.
- .5 Disturbing reinforcement and inserts during concrete placement is prohibited.

- .6 Prior to placing of concrete obtain DCC Representative's approval of proposed method for protection of concrete during placing and curing.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.
- .10 In locations where new concrete dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .11 Do not place load upon new concrete until authorized by DCC Representative.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .3 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by DCC Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete:
 - .4 Finish concrete floor to CSA A23.1/A23.2.
 - .5 Provide scratch finish where floor tile applied.
 - .6 Provide screed finish unless otherwise indicated.
 - .7 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
- .4 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 minimum 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1 Straightedge Method to tolerance schedule as indicated
FF = 20 : FL = 15.

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 56 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials carried out by testing laboratory designated by DCC Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and DCC Representative.
- .4 DCC Representative will pay for costs of tests as specified in Section 01 29 83- Payment Procedures for Testing Laboratory Services.
- .5 DCC 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 DCC Representative not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11- Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 30 00 – Cast in Place Concrete

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM C309-19, Liquid Membrane-Forming Compounds for Curing Concrete.
- .2 CSA International
 - .1 CAN/CSA-A23.1-19 /A23.2-19, 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.
 - .2 Provide copies of WHMIS Safety Data Sheet (SDS) acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.
 - .3 Include application instructions for concrete floor treatment.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Minimum 4 weeks prior to starting concrete finishing work, provide proposed quality control procedures for review by DCC Representative on following items:
 - .1 Hardening.
 - .2 Sealing.
 - .3 Curing.
 - .4 Finishes.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

1.6 SITE CONDITIONS

- .1 Temporary lighting: Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power: Provide sufficient electrical power to operate equipment normally used during construction
- .3 Work area: Make work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature: Maintain minimum 10 degrees C ambient temperature for 7 days before installation and minimum 48 hours after completion of work and maintain relative humidity maximum 40% during same period.
- .5 Moisture: Ensure concrete substrate within moisture limits prescribed by flooring manufacturer.
- .6 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 DCC Representative will arrange for ventilation system to be operated during installation of concrete floor treatment materials. Ventilate area of work as directed by DCC Representative by use of approved portable supply and exhaust fans. Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .2 Provide continuous ventilation during and after coating application.

Part 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 components used compatible and not adversely affect finished flooring products and their installation adhesives.

2.2 MIXES

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

Part 3 Execution

3.1 EXAMINATION

- .1 Verify slab surfaces ready to receive work and elevations as recommended by manufacturer's written instructions.

3.2 APPLICATION

- .1 Apply concrete finishing floor hardener in accordance with manufacturer's written instructions.
- .2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.
- .3 Clean over spray. Clean sealant from adjacent surfaces.

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.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 13 – Masonry and Grout.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CAN/CSA-A165 Series-14 (R2019), CSA Standards on Concrete Masonry Units.
 - .2 CAN/CSA-A179-14 (R2019), Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA-A371-14 (R2019), Masonry Construction for Buildings.
- .2 International Masonry Industry All-Weather Council (IMIAC)
 - .1 Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meetings: Conduct pre-installation meeting one week prior to commencing
- .2 On-site installations work of this Section to:
 - .1 Verify project requirements, including mock-up requirements.
 - .2 Verify substrate conditions.
 - .3 Co-ordinate products, installation methods and techniques.
 - .4 Sequence work of related sections.
 - .5 Co-ordinate with other building subtrades.
 - .6 Review manufacturer's installation instructions.
 - .7 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.
 - .8 Review warranty requirements.

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 masonry and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 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 Ontario, Canada.
- .2 Submit shop drawings detailing temporary bracing required, designed to resist wind pressure and lateral forces during installation.
- .4 Certificates: submit manufacturer's product certificates certifying materials comply with specified requirements.
- .5 Test and Evaluation Reports:
 - .1 Submit certified test reports in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .2 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.
 - .3 Submit data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.
- .6 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.
- .7 Manufacturer's Reports: provide written reports prepared by manufacturer's on-site personnel to include:
 - .1 Verification of compliance of work with Contract.
 - .2 Site visit reports providing detailed review of installation of work, and installed work.

1.5 EXTRA MATERIALS

- .1 Submit manufacturer's instructions in accordance with Section 01 78 00 - Closeout Submittals covering maintenance requirements and parts catalogue, with cuts and identifying numbers.

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 in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Keep materials dry until use.
 - .3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
 - .4 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.

1.7 SITE CONDITIONS

- .1 Ambient Conditions: assemble and erect components when temperatures are above 5 degrees C.
- .2 Weather Requirements: to CAN/CSA-A371.
- .3 Cold weather requirements:
 - .1 To CAN/CSA-A371 with following requirements.
 - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 50 degrees C and protect site from windchill if masonry is exposed to the weather.
 - .3 Maintain temperature of masonry above 0 degrees C for minimum of 7 days, after mortar is installed.
 - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
 - .2 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings, if masonry is exposed to the weather.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
 - .3 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

1.8 WARRANTY

- .1 For Work in this Section 04 05 00 - Common Work Results for Masonry, 12 months warranty period is extended to 24 months

Part 2 Products

2.1 MATERIALS

- .1 Masonry materials are specified elsewhere in related Sections:
 - .1 Section 04 05 13 – Masonry Mortar and Grout.

Part 3 Execution

3.1 INSTALLERS

- .1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

3.2 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section.
 - .1 Co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
 - .1 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from DCC Representative.
- .3 Verification of Conditions:
 - .1 Verify that:
 - .1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete block.
 - .2 Site conditions are acceptable and are ready to receive work.
 - .3 Built-in items are in proper location, and read for roughing into masonry work.
 - .2 Commencing installation means acceptance of existing substrates.

3.3 PREPARATION

- .1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent materials from damage and disfiguration.

3.4 INSTALLATION

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.5 CONSTRUCTION

- .1 Exposed masonry:
 - .1 Remove chipped, cracked, and otherwise damaged units, in accordance with CAN/CSA-A165, in expose masonry and replace with undamaged units.
- .2 Jointing:

- .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.
 - .2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.
 - .3 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Cutting:
 - .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
 - .2 Make cuts straight, clean, and free from uneven edges.
- .4 Building-In:
 - .1 Build in items required built into masonry.
 - .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
 - .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
- .5 Wetting of bricks:
 - .1 Except in cold weather, wet brick having initial rate of absorption exceeding 1 g/minute/1000 mm²: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
 - .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .6 Support of loads:
 - .1 Use 15 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used instead of solid units.
 - .2 Use grout to CAN/CSA-A179 where grout is used instead of solid units.
 - .3 Install building paper below voids to be filled with grout; keep paper 25 mm back from faces of units.
- .7 Provision for movement:
 - .1 Leave 3 mm space below shelf angles.
 - .2 Built masonry to tie in with stabilizers, with provision for vertical movement.
- .8 Loose steel lintels:
 - .1 Install loose steel lintels. Center over opening width.
- .9 Interface with other work:
 - .1 Cut openings in existing work as indicated.
 - .2 Openings in walls: reviewed by DCC Representative.

- .3 Make good existing work. Use materials to match existing.

3.6 SITE TOLERANCES

- .1 Tolerances in notes to CAN/CSA-A371 apply.

3.7 SITE QUALITY CONTROL

- .1 Site Tests, Inspection:
 - .1 Perform site testing in accordance with Section 01 45 00 - Quality Control.
 - .2 Notify inspection agency minimum of 48 hours in advance of requirement for tests.
- .2 Manufacturer's Services:
 - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, and protection of its products, and submit written reports in acceptable format to verify compliance of work with Contract.
 - .2 Manufacturer's site services: provide manufacturer's site services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review work as installation is about to begin.
 - .4 Schedule site visits to review work at stages listed:
 - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of work at 40% and 75% complete.
 - .3 Upon completion of work, after cleaning is carried out.
 - .5 Obtain reports within 3 days of review and submit immediately to DCC Representative.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

3.9 PROTECTION

- .1 Temporary Bracing:
 - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
 - .2 Bracing approved by DCC Representative.
 - .3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .2 Moisture Protection:

- .1 Keep masonry dry using waterproof, non staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
- .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.
- .3 Air Temperature Protection: Masonry work expected to be under indoor conditions. If masonry work is exposed to the elements, protect completed masonry as recommended in 1.7, SITE CONDITIONS.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 - Common Work Result for Masonry.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A179-14 (R2019), Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA-A371-14 (R2019), Masonry Construction for Buildings.
 - .4 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .2 International Masonry Industry All-Weather Council (IMIAC)
 - .1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- .3 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.

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 masonry mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 43 – Environmental Procedures Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .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.
- .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 masonry mortar and grout packages from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
 - .1 Minimum 5 degrees C prior to, during, and 48 hours after completion of masonry work.
 - .2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.
- .2 Weather Requirements: CAN/CSA-A371, International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

Part 2 Products

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
 - .1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10).
 - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
 - .2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA-A179, Type S.
 - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
 - .3 Packaged Dry Combined Materials for mortar: to CAN/CSA-A179, Type S, using gray colour cement.
- .3 Aggregate: supplied by one supplier.
 - .1 Fine Aggregate: to CAN/CSA-A179, silica sand manufactured sand natural sand.
 - .2 Course Aggregate: to CAN/CSA-A179.
- .4 Water: clean and potable.
- .5 Lime:
 - .1 Quick Lime: to CAN/CSA-A179, Type S.
 - .2 Hydrated Lime: to CAN/CSA-A179, Type S.

- .6 Bonding Agent: epoxy type.
- .7 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

2.2 MORTAR MIXES

- .1 Mortar for exterior masonry above grade:
 - .1 Load Bearing: type S based on property specifications.
 - .2 Non-Load Bearing: N based on property specifications.
- .2 Mortar for interior masonry:
 - .1 Load Bearing: type S based on property specifications.
 - .2 Non-Load Bearing: N based on property specifications.
- .3 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for calcium silicate brick and concrete brick: type O based on proportion specifications.
 - .2 Mortar for grouted reinforced masonry: type S based on property specifications.

2.3 MORTAR MIXING

- .1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to within 1% accuracy.
- .2 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.
- .3 Maintain sand uniformly damp immediately before mixing process.
- .4 Using anti-freeze compounds including calcium chloride or chloride based compounds is prohibited.
- .5 Adding air entraining admixture to mortar mix is prohibited.
- .6 Use a batch type mixer in accordance with CAN/CSA-A179.
- .7 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour no more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.
- .8 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.
- .9 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 5 degrees C.

2.4 GROUT MIXES

- .1 Bond Beams: grout mix 10 to 12.5 MPa strength at 28 days; 200-250 mm slump; premixed type in accordance with CSA A23.1/A23.2 mixed in accordance with CAN/CSA-A179 coarse grout.

- .2 Lintels: grout mix 10 to 12.5 MPa strength at 28 days; 200-250 mm slump; premixed type in accordance with CSA A23.1/A23.2 mixed in accordance with CAN/CSA-A179 coarse.
- .3 Grout: Minimum compressive strength of 12.5 MPa at 28 days. Maximum aggregate size and grout slump: CAN/CSA-A179.

2.5 GROUT MIXING

- .1 Mix batched and delivered grout in accordance with CSA A23.1/A23.2 transit mixed.
- .2 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA-A179 coarse grout.
- .3 Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- .4 Using calcium chloride or chloride based admixtures is prohibited.

2.6 MIX TESTS

- .1 Testing Mortar Mix:
 - .1 Test mortar to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA-A179, mortar based on property specification. Test during construction for:
 - .1 Compressive strength.
 - .2 Consistency.
 - .3 Mortar aggregate ratio.
 - .4 Sand/cement ratio.
 - .5 Water content and water/cement ratio.
 - .6 Air content.
- .2 Testing Grout Mix:
 - .1 Test grout to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA-A179, for grout based on property specification. Test during construction for:
 - .1 Compressive strength.
 - .2 Sand/cement ratio.
 - .3 Water content and water/cement ratio.
 - .4 Slump.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.

- .2 Inform DCC Representative 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 DCC Representative.

3.2 PREPARATION

- .1 Apply bonding agent to existing surfaces.
- .2 Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise.

3.4 MIXING

- .1 Pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand pre-approved by DCC Representative.
- .2 Clean mixing boards and mechanical mixing machine between batches.
- .3 Mortar: weaker than units it is binding.
- .4 Contractor to appoint one individual to mix mortar, for duration of project. In event that this individual is changed, mortar mixing must cease until new individual is trained, and mortar mix is tested.

3.5 MORTAR PLACEMENT

- .1 Install mortar to manufacturer's instructions.
- .2 Install mortar to requirements of CAN/CSA-A179.
- .3 Install mortar and grout to requirements of Section 04 05 00.
- .4 Remove excess mortar from grout spaces.

3.6 GROUT PLACEMENT

- .1 Install grout in accordance with manufacturer's instructions.
- .2 Install grout in accordance with CAN/CSA-A179.
- .3 Work grout into masonry cores and cavities to eliminate voids.
- .4 Installing grout in lifts greater than 400 mm, without consolidating grout by rodding is prohibited.
- .5 Displacing reinforcement while placing grout is prohibited.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

- .1 Test and evaluate mortar during construction in accordance with CAN/CSA-A179.
- .2 Test and evaluate grout during construction to CAN/CSA-A179; test in conjunction with masonry unit sections specified.
- .2 Manufacturer's Field Services: in accordance with Section 04 05 00 - Common Work Results for Masonry.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.9 PROTECTION

- .1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 13 – Masonry Mortaring and Grouting
- .3 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 - .3 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
 - .5 ASTM A951/A951M-22, Standard Specification for Steel Wire for Masonry Joint Reinforcement Specification.
- .2 Canadian Standards Association (CSA)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA-A370-18, Connectors for Masonry.
 - .4 CAN/CSA-A371-14, Masonry Construction for Buildings.
 - .5 CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .6 CSA S304-14(R2019), Design of Masonry Structures.
 - .7 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 Reinforcing Steel Manual of Standard Practice, 2004.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for anchorage and reinforcing materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two (2) copies of WHMIS SDS in accordance with Section 01 33 00.

- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer licensed in Province of Ontario, Canada.
 - .2 Submit drawings detailing anchorage details, and placement drawings
 - .3 On placement drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

1.4 QUALITY ASSURANCE

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

1.5 SITE MEASUREMENTS

- .1 Make site measurements necessary for proper fit of members.

1.6 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect anchorage and reinforcing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Bar reinforcement: billet steel to CAN/CSA-A371 and CSA-G30.18, Grade 400, deformed bars, mill finish.
- .2 No field bending of joint reinforcement permitted. Provide manufactured corner and tee pieces only.
- .3 Horizontal mortar joint reinforcement: wire reinforcement to ASTM A951/A951M. Extra heavy duty, truss type reinforcement. 2 parallel side rods welded to a continuous diagonally shaped cross rod forming a truss design with alternating welds not exceeding 200 mm OC. overall. Provide prefabricated T shape sections for intersecting walls and prefabricated corner sections. For use in single wythe walls. Design continuous truss type reinforcement to be embedded in horizontal mortar joints of masonry walls. Width to match thickness of masonry block. Hot dip galvanized coating to ASTM A153/A153M, Class B2, 457 grams per square meter.
 - .1 Extra Heavy Duty rated. 4.7 mm diameter side rods and 4.7 mm diameter cross rods.

- .4 Connectors including wall ties, anchors, dowels and cramps: to CSA-A370 and CSA-S304.
- .5 Corrosion protection: galvanized to CSA-S304 and CSA-A370.
- .6 Expansion Anchors: stainless steel torque controlled expansion anchors Grade 304, stainless steel conforming to ASTM A666. Anchors to be supplied as per Drawings.
- .7 Other Anchors: to CSA-A370.
- .8 Joint Reinforcement Ties: to CAN/CSA-A371.
- .9 Conventional Bolts: to ASTM A307 and ASTM A36/A36M.
- .10 Adhesive Anchors: proprietary systems, in accordance with manufacturers written instructions.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CSA-A370.
- .3 Obtain PMT's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of PMT, weld reinforcement in accordance with CSA-W186.
- .5 Ship reinforcement and connectors clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide DCC Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum five (5) weeks prior to commencing reinforcement work.
- .2 Upon request inform DCC Representative of proposed source of supplied material.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for anchorage and reinforcing materials installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from DCC Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 GENERAL

- .1 Supply and install masonry connectors and reinforcement in accordance with ASTM CSA-A370, CAN/CSA-A371, CSA-A23.1/A23.2 and CSA-S304 unless indicated otherwise.
- .2 Prior to placing concrete, mortar, grout, obtain PMT's approval of placement of reinforcement and connectors.
- .3 Supply and install additional reinforcement to masonry as indicated.
- .4 Coordinate installation of anchors with architectural masonry work.
- .5 Tie masonry veneer to backing in accordance with National Building Code of Canada.
- .6 Install unit, adjustable, single wythe, and multiple wythe joint reinforcement where indicated.

3.4 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry beams, masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA S304.1, CAN/CSA-A371, and CAN/CSA-A179.
- .3 Support and position reinforcing bars in accordance with CAN/CSA-A371.

3.5 GROUTING

- .1 Grout masonry in accordance with CSA S304.1, CAN/CSA-A371 and CAN/CSA-A179 and as indicated.

3.6 ANCHORS

- .1 Supply and install metal anchors in accordance with CAN/CSA-A370 and CAN/CSA-A371 and as indicated.
- .2 Screws to be installed in holes drilled with matched tolerance carbide-tipped drill bits. Installation to be in accordance with manufacturer's instructions.
- .3 Install expansion anchors where indicated as per manufacturer's written instructions.
- .4 Supply and install lateral support and anchorage in accordance with CSA S304 and as indicated.

3.7 MOVEMENT JOINTS

- .1 Reinforcement not continuous across movement joints unless otherwise indicated.

3.8 FIELD BENDING

- .1 Do not field bend reinforcement and connectors except where indicated or authorized by DCC Representative.
- .2 When field bending authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars and connectors with cracks or splits.

3.9 FIELD TOUCH-UP

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

3.10 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 13 – Masonry Mortaring and Grouting
- .3 Section 04 05 19 – Masonry Anchorage and Reinforcing

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM E336-19a, Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings.
- .2 CSA Group
 - .1 CSA-A165 Series-14, CSA Standards on Concrete Masonry Units consists: A165.1, A165.2, A165.3.
 - .2 CAN/CSA-A371-14(R2019), Masonry Construction for Buildings.
 - .3 CSA S304.1-14(R2019), Design of Masonry Structures.
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2020 (NBC).
- .4 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1168-17, Adhesive and Sealant Applications.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00.
- .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.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Offload concrete unit masonry packages using equipment that will not damage the surfaces.
 - .2 Do not use brick tongs to move or handle masonry.
- .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 Do not double stack cubes of concrete unit masonry.
 - .3 Cover masonry units with non-staining waterproof membrane covering.
 - .4 Allow air circulation around units.
 - .5 Installation of wet or stained masonry units is prohibited.
 - .6 Keep concrete unit masonry in individual cardboard packaging provided by manufacturer until units are ready to be installed.
 - .7 Store and protect concrete unit masonry from nicks, scratches, and blemishes.
 - .8 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Smooth face fire resistant concrete block units - one (1) hour fire-resistance rating: to CSA-A165 Series:
 - .1 Classification: H/15/A/M except as modified by fire resistance requirements specified below.
 - .2 Fire resistant characteristics: aggregate used in units and equivalent thickness of units to the Supplement to the National Building Code of Canada for fire-resistance ratings indicated.
 - .3 Dimensions Nominal: 190 mm wide x 200 mm high x 400 mm long.
 - .4 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.
- .2 Split face fire resistant concrete block units - one (1) hour fire-resistance rating: to CSA-A165 Series:
 - .1 Classification: H/15/A/M except as modified by fire resistance requirements specified below.
 - .2 Fire resistant characteristics: aggregate used in units and equivalent thickness of units to the Supplement to the National Building Code of Canada for fire-resistance ratings indicated.
 - .3 Profile/Texture for Architectural Concrete Unit Masonry:
 - .1 Split faced: full split units to match existing.
 - .2 Surface texture: sandblasted units to match existing surface texture.
 - .4 Colour:

- .1 Integrally coloured pre-finished architectural concrete block with one or more faces ground to expose variegated colours of natural aggregates; with factory-applied clear satin gloss acrylic finish.
- .2 DCC Representative to select colour of concrete block from manufacturer's range to match existing concrete block wall.
- .5 Dimensions Nominal: 190 mm wide x 200 mm high x 400 mm long.
- .6 Special shapes: provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.
- .3 Smooth face fire resistant concrete block units - four (4) hour fire-resistance rating: to CSA-A165 Series:
 - .1 Classification: H/15/A/M except as modified by fire resistance requirements specified below.
 - .2 Fire resistant characteristics: aggregate used in units and equivalent thickness of units to the Supplement to the National Building Code of Canada for fire-resistance ratings indicated.
 - .3 Dimensions Nominal: 290 mm wide x 200 mm high x 400 mm long.
 - .4 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.
- .4 Smooth face concrete block: to CSA-A165 Series:
 - .1 Classification: H/15/A/M
 - .2 Dimensions Nominal: 190 mm wide x 200 mm high x 400 mm long.
 - .3 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.

2.2 CLEANING COMPOUNDS

- .1 Use low VOC products in compliance with SCAQMD Rule 1168.
- .2 Compatible with substrate and acceptable to masonry manufacturer for use on products.
- .3 Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.

2.3 TOLERANCES

- .1 Tolerances for standard concrete unit masonry tolerances in accordance with CSA-A165.1, supplemented as follows:
 - .1 Maximum variation between units within specific job lot not to exceed 2 mm.
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
 - .3 Out of square tolerance not to exceed 2 mm.
- .2 Tolerances for architectural concrete masonry units in accordance with CSA-A165.1, supplemented as follows:
 - .1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2 mm.

- .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
- .3 Out of square tolerance not to exceed 2 mm.
- .4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for concrete unit masonry installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 PREPARATION

- .1 Protect adjacent finished materials from damage due to masonry work.

3.3 INSTALLATION

- .1 Concrete block units:
 - .1 Bond: running.
 - .2 Coursing height: 200 mm for one block and one joint.
 - .3 Jointing: flush where exposed or where paint or other finish coating is specified.
- .2 Special Shapes:
 - .1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.
 - .2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
 - .3 End bearing: not less than 200 mm.

3.4 REINFORCEMENT

- .1 Install reinforcing in accordance with Section 04 05 19.

3.5 CONNECTORS

- .1 Install connectors in accordance with Section 04 05 19.

3.6 MORTAR PLACEMENT

- .1 Place mortar in accordance with Section 04 05 13.

3.7 GROUT PLACEMENT

- .1 Place grout in accordance with Section 04 05 13.

3.8 CONSTRUCTION

- .1 Cull out masonry units, in accordance with CSA-A165 and range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.
- .2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.
- .3 Construct masonry walls using running bond unless otherwise noted.
- .4 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
- .5 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .6 Install movement joints and keep free of mortar where indicated.
- .7 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.
- .8 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .9 Tamp units firmly into place.
- .10 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .11 After mortar has achieved initial set up, tool joints.
- .12 Do not interrupt bond below or above openings.
- .13 Provide minimum 25 mm deflection gap at top of all non-load bearing masonry partition walls. Refer to structural drawings and details for lateral support at the top of all masonry partition walls.

3.9 REPAIR/RESTORATION

- .1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.10 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 01 45 00 supplemented as follows:
 - .1 Concrete masonry units will be sampled and tested by independent testing agency appointed and paid by DCC Representative in accordance with CSA S304.1.
 - .2 Notify inspection agency minimum of twenty-four (24) hours in advance of requirement for tests.
- .2 Manufacturer's Field Services: in accordance with Section 04 05 00.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
 - .2 Standard Concrete Unit Masonry:

- .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

3.12 PROTECTION

- .1 Brace and protect concrete unit masonry in accordance with Section 04 05 00.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 31 00 Steel Decking.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM A325M-13 (withdrawn), Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
 - .1 Handbook of the Canadian Institute of Steel Construction.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA G40.20/G40.21-18, 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 CAN/CSA-S16-19, Limit States Design of Steel Structures.
 - .4 CSA W47.1-1 (R2019), Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
- .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
 - .1 NACE No. 3/SSPC SP-6-06, Commercial Blast Cleaning.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Erection drawings:
 - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.

- .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
- .4 Source Quality Control Submittals:
 - .1 Upon request submit copies of mill test reports 4 weeks prior to fabrication of structural steel.
 - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
 - .2 Provide mill test reports certified by metallurgists qualified to practice in Province of Ontario, Canada.
- .5 Fabricator Reports:
 - .1 Provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

2.2 MATERIALS

- .1 Structural steel: to CSA-G40.20/G40.21 350W.
- .2 Bolts, nuts and washers: ASTM A325M.
- .3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .4 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².

2.3 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16, and in accordance with reviewed shop drawings.
- .2 Continuously seal members by continuous welds.

2.4 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.3 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to DCC Representative for direction before commencing fabrication.

3.4 MARKING

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.5 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of DCC Representative.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

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

3.6 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by and independent testing laboratory retained by the contractor.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by DCC Representative.
- .3 Submit test reports to DCC Representative within 2 weeks of completion of inspection.
- .4 Contractor shall include the cost of tests in their bid price.

3.7 FIELD PAINTING

- .1 Paint in accordance with Section 09 91 00 - Painting.
 - .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 12 23 Structural Steel for Buildings.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A 53/A 53M-22, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 CSA Group
 - .1 CSA G40.20-18 /G40.21-18, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16-19, Design of Steel Structures.
 - .3 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .4 CSA W59-18, Welded Steel Construction (Metal Arc Welding) Metric.
- .3 Green Seal Environmental Standards (GS)
 - .1 GS-11-2011, Paints and Coatings.
- .4 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
- .5 ULC Standards
 - .1 UL 2768-2011, Architectural Surface Coatings.
 - .2 UL 2760-2011, Surface Coatings - Recycled Water-borne.

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 sections, pipe, bolts, tubing, plates 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 The Province of Ontario, Canada.

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

1.4 QUALITY ASSURANCE

- .1 Test Reports: 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.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions 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 Replace defective or damaged materials with new.

Part 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 flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Design hand railings, balustrades, guards, all connections to support minimum horizontal live load 0.75 kN/m or a concentrated load of 1.0kN

- .5 Design meta balustrades, railings, and connections to NBC vertical and horizontal live load requirements.
- .6 Detail railings to NAAMM Metal Stairs Manual fifth Edition 1992, NAAMM Commercial quality.
- .7 Exposed welds 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.

2.4 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 ANGLE LINTELS

- .1 Steel angles: galvanized, size(s) indicated for openings. Provide 150 mm minimum bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles as indicated.

2.6 PIPE RAILINGS

- .1 Steel pipe railings, posts, gate frame: nominal 50mm outside diameter and min. 3mm wall thickness, formed to shapes as indicated, fully welded.
- .2 Mounting base plates: minimum 6 mm thick mounting plates, min. 100x100mm size to resist required design force applied to the post, required, drilled for anchor bolts to existing floor assembly of mezzanine, welded construction.
- .3 Sleeves: sized to accept rail posts.
- .4 Panel framing: 25mm x 4mm thick plates with length to suite opening of panel. Plates to be welded to steel pipe with plate located on either side of panel infill. Weld plate to panel infill.
- .5 Panel Infill: steel grating, pressure locked construction, minimum 4.5 mm x 38 mm bearing bars, 9 mm o.c., round cross bars 100 mm o.c., plain surface
- .6 Gate Hardware:
 - .1 Hinges: 75x75mm weldable butt steel hinge for medium duty use.
 - .2 Latch: weldable, heavy duty self-locking gravity gate latch with latch pin. Latching to be design to be lockable with pad lock (n.i.c.).

2.7 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: prime coat painted.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from DCC Representative.

3.2 ERECTION - GENERAL

- .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 DCC Representative 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 wherewith bolts to CSA S16Weld field connection.
- .7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:
 - .1 Primer: maximum VOC limit 250 g/L to GS-11.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
 - .1 Primer: maximum VOC limit 250 g/L to GS-11.

3.3 PIPE RAILINGS

- .1 Install steel channel frames to openings as indicated.

3.4 CHANNEL FRAMES

- .1 Install steel channel frames to openings as indicated.

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.

3.6 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

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O141-05(R2009), Softwood Lumber.
 - .3 CSA O151-17, Canadian Softwood Plywood.
 - .4 CAN/CSA-O325.0-07, Construction Sheathing.
- .2 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .3 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2017.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.

1.4 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 in dry location, indoors, off ground 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.

Part 2 Products

2.1 MATERIALS

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
 - .1 S2S is acceptable for
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .4 Post and timbers sizes: "Standard" or better grade.
- .3 Panel Materials:
 - .1 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .1 Urea-formaldehyde free.
- .4 Wood Preservative:
 - .1 Surface-applied wood preservative: clear or 5% pentachlorophenol solution, water repellent preservative.
 - .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.
 - .3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

2.2 ACCESSORIES

- .1 Galvanizing: ASTM A153. Hot-Dipped Zinc coated galvanized fasteners for all work.
- .2 Nails, spikes and staples: to CSA B111.
- .3 Screws. self-drilling for installation to steel stud framing.
- .4 Bolts: diameter as required, complete with galvanized nuts and washers.
- .5 Construction adhesive: to ASTM D3498 and ASTM C557. One component, polyurethane based, moisture curing adhesive. Waterproof, non-shrinking, VOC: 4% by weight. 90% solids by weight. Contains no chlorinated solvents or water. For exterior or interior applications. Cures in cold temperatures. Service temperature: minus 18 degrees C to plus 71 degrees C. Bond strength development: at 23 degrees C and 24 hours: minimum 540 PSI.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for rough carpentry installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Use member sizes to match existing where required to replace existing wood components.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes and other work as required.
- .5 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .6 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- .7 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

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.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International. (ASTM).
 - .1 ASTM A653/A653M-17. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM C612-14. Standard Specification for Mineral Fibre Block and Board Insulation.
 - .3 ASTM C518-17. Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .2 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S702-14. Standard for Mineral Fibre Thermal Insulation for Buildings.
- .3 CSA Group. (CSA).
 - .1 CAN/CSA 0141-05(R2014). Softwood Lumber.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's standard product data sheets. Submit instructions, printed product literature and data sheets. Include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

- .1 Installer qualifications. Company specializing in the installation and modification of metal roofing assemblies with particular experience in the installation and modification faced sealed, standing seam metal roofing assemblies.
- .2 Convene pre-installation meeting one week prior to beginning Work of this Section. Arrange or Contractor, DCC Representative and Trade responsible for work of this section to attend. Meeting will address the following:
 - .1 Verify extent of Work including demolition work at new openings.
 - .2 Verify details and materials.
 - .3 Verify coordination procedures for Work of other sub-trades including installation of new structural steel members.
 - .4 Verify manufacturer and profile of existing standing seam metal roofing panels and confirm colour match with existing.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name and Manufacturer.
- .2 Storage and protect materials indoors in a clean, dry and well ventilated location and in accordance with Manufacture's recommendations.

- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 ROOFING COMPONENTS

- .1 Structural Steel Framing: existing steel structure elements to remain. New Structural steel framing and supports as indicated and as specified in Section 05 12 23 - Structural Steel for Buildings.
- .2 Liner panel: existing interior metal liner panel to remain. New: 0.61 mm galvanized sheet metal. Overall panel width and profile to match existing. Factory prefinished, manufacturers standard factory applied paint coating. Colour: white or to match existing.
- .3 Wood blocking, cants and curbs: to CAN/CSA 0141. S-P-F, S4S, Construction no 1 grade. 38 mm thick, sizes as indicated in the drawings.
- .4 Roof Insulation:
 - .1 Infill locations: semi-rigid glass fibre thermal insulation to CAN/ULC S702/. Type I, unfaced, friction fit between purlins.
 - .2 New openings: mineral wool board insulation: to ASTM C612, type IVB and ASTM C518. RSI 0.70 at 25.4 mm thickness.
- .5 Metal Roofing Panels:
 - .1 New openings: existing roof panel, cut on site to suit new opening sizes and locations.
 - .2 Infill: new standing seam metal roofing panels. Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 or 340. having a nominal minimum core thickness 0.61mm. Profile and finish: to match existing roofing panels in place. Final colour and finish coating: manufacturer's standard factory coating application to match existing roofing panels.
- .6 Accessories:
 - .1 Isolation coating: alkali resistant bituminous paint.
 - .2 Gas line supports: non- penetrating, sleeper type.
 - .3 Penetration flashings: prefabricated boot. Grey EPDM or silicone universal roof boot. Resistant to ozone and UV weathering and high temperatures up to 225 degrees C. Design the flashing to provide a watertight flashing to the penetrating pipe. Design the bottom flange of the flashing to conform to the profile of the metal roof cladding panel without cutting and accommodate the roof slope. Attachment: self tapping stainless steel cap screws. Provide with compatible low modulus silicone fixing kit and flashing adhesive.
 - .4 Premanufactured curbs: prefabricated curb assembly as recommended by manufacturer of mechanical units. Height and profile as indicated. Profile bottom edge as required to match existing metal roofing panels. Provide crickets as required to direct water away at upper end of units.
 - .5 Fasteners: as recommended by manufacturer
 - .6 Adhesive: as recommended by Manufacturer
 - .7 Sealants: as specified in Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 EXAMINATION OF ROOF DECKS

- .1 Inspect conditions of existing roofing. Verify all existing conditions, including:
 - .1 Existing structural steel framing at new roof opening locations.
 - .2 Existing gas lines.
 - .3 Existing vents.
- .2 Prior to beginning of work ensure that decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal. Ensure that curbs have been installed as required for new mechanical units.
- .3 Do not install roofing materials during rain or snowfall.

3.2 ROOFING REPAIR (NEW ROOF OPENINGS AND PENETRATIONS)

- .1 Cut openings in existing roof assembly as required to suit new mechanical equipment and as indicated in the drawings. Carefully locate openings for mechanical and structural penetrations. Use metal shears and cut off saws as necessary. Do not use cutting torches unless specifically confirmed in writing by DCC Representative. Cut new openings to suit new construction refer to Section 02 41 19 - Selective Demolition.
- .2 Patch and replace interior metal liner panel to ensure edges are completely supported at perimeter of new openings. Fold joints and seams. Seal ends of new panels to existing liner panels or purlins.
- .3 Install structural steel framing at perimeter of new openings as indicated and as required to support roof assembly and as recommended by Manufacturer of Roof assembly.
- .4 Install new multi ply, built-up solid wood curbs at perimeter of new openings as indicated.
- .5 Install new premanufactured metal curbs at perimeter of new mechanical openings in conformance with mechanical unit Manufacturer's written requirements.
- .6 Install insulation at inside perimeter blocking / roof curb as indicated. Coordinate with mechanical installations. Ensure that all roof areas that are disturbed by the work are completely filled with insulation prior to installation of Steel roofing panels.
- .7 Standing seam metal roofing. Install standing seam roofing panels and seal to perimeter of new curbed openings as recommended by Manufacturer to create weathertight joints.
 - .1 Provide mechanical fasteners as recommended by manufacturer.
 - .2 Provide bead of sealant at expose edge of roofing panel to flange.
- .8 Roof pipe penetrations. Install new penetration flashings and seal to metal roofing as detailed and in accordance with manufacturer's recommendations.
- .9 Flashing: Install premanufactured metal flashing on curb as detailed and as recommended by manufacturer.

3.3 ROOFING REPAIR (ROOF INFILL)

- .1 Frame between purlins across opening(s) as required to meet loading requirements for roof assembly.

- .2 Install new sheet metal closure panel as indicated, fold seam between sheets, seal edges to existing liner panel or purlins as required.
- .3 Install new roof insulation as required to meet the required thermal performance/ thickness of existing assembly
- .4 Install new roof panels in area indicated. Site verify locations for patching existing opening or providing full length panels.
- .5 Construct standing seams to match existing and ensure a permanent, weathertight assembly.
- .6 Where existing materials are to be re-installed, clean all edges of components free of sealants and adhesives. Ensure materials are ready for installation as recommended by Manufacturer.

3.4 CLEANING

- .1 Remove bituminous markings from finished surfaces.
- .2 Remove and dispose of excess materials from site on completion.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 02 41 19 – Selective Demolition
- .2 Section 08 11 00 – Metal Doors and Frames
- .3 Section 06 08 99 – Rough Carpentry for Minor Works

1.2 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B18.6.3-2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .2 ASTM International
 - .1 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM C553-13(2019), Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .3 ASTM D2369-20, Test Method for Volatile Content of Coatings.
 - .4 ASTM D2832-92(2016), Standard Guide for Determining Volatile and Non-volatile Content of Paint and Related Coatings.
 - .5 ASTM D5116-17, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
 - .6 ASTM E96/E96M-22AE1, Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
 - .7 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .3 Green Seal Organization (GS)
 - .1 GS-36 (2013), Adhesive for Commercial Use.
- .4 ULC Standards
 - .1 CAN/ULC-S702.2-15, Standard for Wood Fibre Insulating Boards for Buildings.
 - .2 CAN/ULC-S741 (08) , Standard for Air Barrier Materials – Specification.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: sequence with other work in accordance with Section 02 41 19 – Selective Demolition and 08 11 00 – Metal Doors and Frames.

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 metal siding and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 1 copies of WHMIS SDS in accordance with Section 01 35 43- Environmental Procedures.
 - .3 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.
 - .2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, and related work.
- .4 Samples:
 - .1 Submit samples of siding material. Colour will be selected by DCC Representative from manufacturer's extended colour range. Submit duplicate 200 mm x 200 mm samples of siding in colour and profile specified.

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 installed products for incorporation into manual.

1.6 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.

1.7 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 indoors and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect steel siding from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: remove for reuse by manufacturer of packaging materials, padding, crates, pallets, as specified in Construction Waste Management Plan in accordance with Section 01 74 19- Waste Management and Disposal.

1.8 SITE CONDITIONS

- .1 Execute work of this Section within environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer.

1.9 WARRANTY

- .1 Manufacturer's warranty: Submit, for DCC Representative acceptance, manufacturer's standard warranty document executed by authorized company official and Contract Documents.

Part 2 Products

2.1 MATERIALS

- .1 Steel siding: Fabricated from commercial grade to Z275 galvanized sheet steel:
 - .1 Profile: refer to drawings for profile and dimensions.
 - .2 Finish coating: factory precoated with fluorocarbon paint finish, 2 coat system dry paint film thickness of 0.025 mm.
 - .3 Colour: colour selected by DCC Representative from manufacturers extended range of colours.
 - .4 Back coating: ASTM A653/A653M, grade A, coating designation Z275.
 - .5 Gloss: 35 ± 5 units at 60° angle.
 - .6 Thickness: 0.91mm (20 gauge).
- .2 Steel Sub-Girts Lintel: Z or U Shape, fabricated from galvanized sheet steel to support edge of siding and liner panel for the new openings and as per manufacturer's recommendations.
- .3 Interior liner panel: fabricated from factory prefinished sheet metal with Z275 zinc coating. Provide in maximum available lengths suitable for opening.
 - .1 Profile: ribbed interior liner panel to act as an interior air / vapour barrier.
 - .2 Gauge: 0.76 mm (22 gauge).
 - .3 Factory applied caulking in the side laps.
 - .4 Finish: factory applied SMP coating system.
 - .5 Colour: selected by PMT from manufacturer's full and extended range of available colours.
- .4 Fasteners: screws to ASME B18.6.3 galvanized steel purpose made, head colour same as exterior sheet, dished steel/neoprene washer.
- .5 Sealants: in accordance with Section 07 92 00- Joint Sealants.

- .1 Test for acceptable VOC emissions in accordance with ASTM D2369 and ASTM D2832.
- .2 Adhesives and sealants: VOC limit 30 g/L maximum to GS-36.
- .6 Touch-up paint: as recommended by panel manufacturer. Colour to match.
- .7 Isolation coating: as recommended by panel manufacturer.

2.2 ACCESSORIES

- .1 Exposed trim: inside corners, outside corners, cap strip, drip cap, under sill trim, starter strip and window/door trim of same material as cladding, with fastener holes pre-punched.
- .2 Non-exposed accessories:
 - .1 Insulation: Type 1, blanket mineral fibre to ASTM C553 and CAN/ULC-S702.2. Thickness double layered to suit existing cavity min. 210mm thickness. Insulation layers staggered joints to meet U value of .158.
 - .2 Self-Adhesive Membrane: SBS modified asphalt with cross laminated polyethylene face. Used as transition between door frame, duct penetrations and membrane with exterior wall assembly system.
 - .1 Properties:
 - .1 Thickness: 1.0 mm
 - .2 Water vapour permeance (ASTM E96/E96M): 2.8 ng/Pa.m.s
 - .3 Air permeability (ASTM E283): < 0.003 L/sec. m² @ 75 Pa.
 - .4 Flexibility at cold temperature: -30°C
 - .5 Static puncture - membrane: 178 N.
 - .6 Elongation: 200%.
 - .7 Moisture absorption: 0.1%.
 - .8 Lap adhesion: 1750 N/m.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts acceptable in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from DCC Representative.

3.2 PREPARATION

- .1 Clean surfaces thoroughly prior to installation.
- .2 Repair substrate flaws or defects before applying siding or soffits.
- .3 Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under project conditions.

3.3 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.

3.4 INSTALLATION

- .1 Install steel siding in accordance with CSSBI standards and manufacturer's written instructions.
- .2 Self-Adhesive Membrane:
 - .1 Roll entire membrane, firmly and completely as soon as possible to ensure proper contact.
 - .2 Cut membrane to fit around penetrations and apply bead of sealant to seal voids which may have been caused by fitting of membrane.
 - .3 Tie membrane into window and door frame interface sheet, to maintain continuity of air/vapour retarder. Position lap seal over firm bearing.
 - .4 Coordinate installation of wall air/vapour retarder with roof vapour retarder to maintain continuity.
 - .5 Seal lap joints of Self-Adhesive Membrane as follows:
 - .1 Stagger vertical laps to avoid build-up of membrane at localized areas.
 - .2 Overlap horizontal and vertical joints minimum 50 mm.
 - .3 Seams to be roll as part of entire membrane, firmly and completely as soon as possible to ensure proper contact.
- .3 Install continuous starter strips, inside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.
- .4 Install outside corners, fillers and closure strips with carefully formed and profiled work.
- .5 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .6 Attach components in manner not restricting thermal movement.
- .7 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00- Joint Sealants.
- .8 Install interior liner panel together with sub-girts to steel framing. Interlock liner side joints. Lap all ends at least 100 mm over a support. Seal joints in liner panel with sealant to act as an air/vapour barrier

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 recycling in accordance with Section 01 74 19- 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 preformed metal siding installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 08 99 – Rough Carpentry
- .2 Section 07 01 45 – Metal Roof Repairs
- .3 Section 07 92 00 – Joint Sealant
- .4 Section 08 11 00 – Metal Doors and Frames

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A653/A 653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM D523-14(2018) , Standard Test Method for Specular Gloss.
- .2 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual 2012.
- .3 FM Global
 - .1 Property Loss Prevention Data Sheets 1-49 Perimeter Flashing.
- .4 Green Seal Environmental Standards
 - .1 Standard GS-11-2021, Paints, Coatings, Stains, and Sealers.
 - .2 Standard GS-36-2021 , Adhesives for Commercial Use.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (MSDS).
- .6 Sheet Metal and Air Conditioning Contractors Association of North America (SMACNA)
 - .1 Architectural Sheet Metal Manual (2012)
 - .2 Residential Sheet Metal Guidelines (2001)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature including product specifications and technical data sheets for sheet metal flashing fasteners and accessory materials. Include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS SDS - Material Safety Data Sheets in accordance with Division 01.

- .3 Samples:
 - .1 Submit 50 x 50 mm samples of each type of sheet metal material, finishes and colour.

1.4 PRE-INSTALLATION MEETING

- .1 Include sheet metal flashing and trim on agenda of pre-installation meetings of affected sections.

1.5 MOCK-UPS

- .1 Include flashings in mock-ups as specified for work of other affected sections.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 01.
- .2 Handle and store flashing materials to prevent creasing, buckling, scratching, or other damage.
- .3 Prevent contact of dissimilar metals during storage and protect from corrosive material elements.

Part 2 Products

2.1 BASE SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: 1.22 mm thickness, 0.61 mm nominal core thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied silicone modified polyester.
 - .1 Class F2S.
 - .2 Colour selected by DCC Representative from manufacturer's full range.
 - .3 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.
 - .4 Coating thickness: not less than 25 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 1000 hours.
 - .2 Humidity resistance exposure period 1000 hours.
 - .6 Sheet metal core thickness: minimum 0.61 mm.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CGSB 37-GP-5Ma.
- .3 Sealants: to Section 07 92 00.
- .4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

- .5 Fasteners: of same material as sheet metal, to CSA B111, ring thread, flat head roofing nails of length and thickness suitable for metal flashing application.
- .6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

2.4 FABRICATION

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

2.5 METAL FLASHINGS

- .1 Form flashings, copings and fascias to profiles indicated of prefinished galvanized steel.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install sheet metal work as detailed CRCA FL series details and as detailed.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal.
 - .1 Secure in place and lap joints 100 mm.
 - .2 Provide self-adhesive membrane to tie into adjacent assemblies.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
 - .1 Flash joints using S-lock forming tight fit over hook strips, as detailed.
- .5 Lock end joints and caulk with sealant.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .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

Part 1. General

1.1. DESIGN REQUIREMENTS

- .1 Design guardrails in accordance with National Building Code (NBC) as well as all local and provincial requirements to withstand structural loads without exceeding the allowable working stresses of the materials. Design components to withstand dead and live loads, acting parallel and normal to plane of system as determined in accordance with clause 4.1.5.14 of NBCC 2015.
 - .1 Top railing height: 1070 mm above top of walkway.
 - .2 Provide middle railing.
 - .3 Design system to accommodate movement within railing system and movement between railings and adjacent building components without damage to components.
- .2 Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.2. REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A653/A653M-17. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B85/B85M-18e1. Standard Specification for Aluminum-Alloy Die Castings.
 - .3 ASTM B221-14. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3. SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and data sheets for pre-manufactured components including walkways and guardrails assembled from standard components. Provide component dimensions. Describe components within assembly.
 - .1 Describe attachment, fasteners and connections.
 - .2 Include product characteristics, performance criteria, physical size, finish, limitations and standard installation details.
- .3 Submit Shop Drawings:
 - .1 Provide proposed layout for review prior to manufacture.
 - .2 Provide scaled plans, sections and details for all assemblies. Indicate junctions with adjacent construction. Indicate junctions between units. Provide elevations.
 - .3 Indicate construction details, profiles, materials and core thicknesses of all components. Indicate sizes of sections and thickness of sheet products. Indicate trim and closure components.
 - .4 Indicate connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

- .5 Indicate location of caulking. Indicate arrangement of hardware and required clearances to surrounding structure.
- .6 Provide structural and physical characteristics of structural members and anchors. Indicate dimensional limitations and special installation requirements.
- .7 Submit details of removable components. Indicate location and description of exposed fasteners for components that are removable.
- .8 Indicate assembly details and dimensions of fabrication.
- .9 Indicate installation details and sequencing.
- .10 Indicate system dimensions and tolerances, adjacent construction, anticipated deflection under load and field splices required.
- .11 Submit Shop Drawings prepared, sealed and signed by a Professional Engineer registered in the Province of Ontario. Prepare, seal and sign all shop drawings. Shop drawings shall show both design and installation requirements of guardrails including support connections. Provide stamped, Engineered Shop drawings for all fabricator designed assemblies, components and connections.
- .12 Indicate cuts, copes, holes, threaded fasteners, rivets and welds. Indicate welds by AWS welding symbols.
- .4 Submit test results for clamping devices. Include results of product tensile load testing for attachment clamp, issued by a recognized independent testing laboratory, showing ultimate load-to-failure value of attachment.
- .5 Indicate type and location of exposed finishes.
- .6 Submit installation drawings, indicate all information necessary for assembly, including member size, base plate elevation, anchor bolt size and location.
- .7 Submit manufacturer's installation and maintenance instructions.
- .8 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .9 Submit letter on manufacture's letterhead certifying railing system meets the NBC design loads for Guardrails.

1.4. DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name and Manufacturer.
- .2 Store materials indoors in dry location and in accordance with Manufacture's recommendations in clean, dry, well ventilated area.
- .3 Replace defective or damaged materials with new.

Part 2. Products

2.1. ROOF WALKWAYS

- .1 Pre-engineered rooftop walkway system consisting of non-slip, interlocking grating planks with support plates and attachment clamps to mount to a standing seam panel metal roof. Components as follows:
 - .1 Grating: nominal 300 mm wide x manufacturer's standard lengths to meet layout as indicated. Fabricated from minimum 1.30 mm thick roll formed hot dip galvanized steel sheet. Galvanized coating: to ASTM A653, G90 PG rating. Minimum 0.75 mil thick zinc coating. Grating nominal 68 mm height. Interlock edges with male/female legs providing a friction lock to eliminate horizontal movement between sections. Surface: anti skid meeting OSHA requirements. Maximum deflection: L/240. Provide with hold down clips to secure grating to plates with stainless steel self drilling, self tapping screws.
 - .2 Support plate: nominal 2.0 mm hot dipped PG galvanized steel sections formed to span standing seams.
 - .3 Clamps: design clamps to provide secure attachment to standing seam metal roofs and as follows:
 - .1 With only minor dimpling of panel seams.
 - .2 Without penetrations through roof seams or panels.
 - .3 Without use of sealant or adhesives.
 - .4 Without voiding roof warranty.
 - .5 To withstand exposure to the weather and environmental elements, and resist design forces without failure.
 - .6 Fabricate clamps from 6061-T6 aluminum extrusions conforming to ASTM B221 or aluminum castings conforming to ASTM B85. Flanged and profiled to suit existing roof panel profile. Set screws: 300 Series stainless steel, 18-8 alloy, 9.5 mm diameter, with round head point. Provide attachment bolts and washers: 300 series stainless steel, 18-8 alloy, 8 mm diameter, hex head flanged cap bolt to secure support plates to clamps.
 - .4 Hardware: stainless steel or hot dip galvanized finish as required for a complete installation and as recommended by Manufacturer.

2.2. ROOF SAFETY GUARDRAIL

- .1 Modular safety guardrail system: to meet the requirement of the NBC and OH&S.
 - .1 Provide metal guardrail system integral with walkway system utilizing same attachment clamps that supports the walkway assembly. Attachment system to not penetrate existing standing seam metal roofing panels.
 - .2 Fittings: slip on, site assembled fittings with setscrews manufactured from high tensile aluminum magnesium alloy.
 - .3 Posts: nominal 48 mm OD schedule 40 pipe or as required to meet design loads.
 - .4 Rails: Nominal 48 mm OD schedule 40 pipe or as required to meet design loads.
 - .5 Finish: galvanized coating: to ASTM A653, G90 PG rating. Minimum 0.75 mil thick zinc coating.

- .6 Accessories: support plate and other accessories as required for a complete installation to existing standing seam metal roofing panels.
- .7 Hardware: hot dip galvanized or stainless-steel bolts, washers and fittings as required for a complete installation and as recommended by Manufacturer.

2.3. FABRICATION

- .1 Do not start fabrication until shop drawings have been reviewed and accepted. Fabricate to profiles, elevations and sizes as indicated in the Drawings. Face dimensions detailed are maximum permissible sizes.
- .2 Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Refer to drawings for detailing and sizes.
- .3 Fabricate railing systems in accordance with manufacturers written instructions.
- .4 Provide longest practical lengths for shipping and handling limitations. Mark units for field assembly and to co-ordinate installation. Use connections that maintain the structural value of the joined pieces.
- .5 Fabricate railing systems with minimum clearances around perimeter of assembly as recommended by manufacturer without adversely affecting the installation and normal expansion and contraction of components.
- .6 Fabricate all components strong, rigid, and neat in appearance, Straight, square, true, and free of defects, warp, or buckle.
- .7 Design and fabricate to permit modular construction and to allow for thermal expansion. Accurately form connections with exposed faces flush; mitres and joints tight.
- .8 Joints and corners must be precisely machined, solidly fastened together and sealed to achieve indicated performances. Joints must be tight and in the same plane.
- .9 Prepare components to receive anchor devices. Install anchors.
- .10 Reinforce members for external imposed loads.
- .11 Bolt connections. Countersink exposed fastenings. Make exposed connections of same material, colour and finish as base material on which they occur.
- .12 Provide floor anchors as indicated or required for attachment.
- .13 Fabricate components square and true with maximum tolerance of plus or minus 1.5 mm for units Brace sections to maintain squareness and rigidity during shipment and installation.

Part 3. Execution

3.1. EXAMINATION OF ROOF DECKS

- .1 Inspect existing conditions of roofing prior to new Work.
- .2 Prior to beginning of work ensure that decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal. Ensure that curbs have been installed as required for new mechanical units.

3.2. INSTALLATION - ROOF WALKWAYS

- .1 Install roof walkways in accordance with Manufacturer's written instructions. Do not

penetrate metal roofing.

- .2 Install clamps. Place clamps at maximum 900 mm OC or as required by in service loads.
- .3 Place clamps in straight, aligned rows. Tighten set screws to manufacturer's recommended torque. Randomly test set screw torque using calibrated torque wrench. Attach flange adapter to clamp and tighten bolts to recommended torque.
- .4 Attach support plates to top surface of clamps. Tighten bolts to manufacturer's recommended torque. Do not cantilever support plates or cross members more than 100 mm beyond last clamp at ends.
- .5 Install grating to support plates and secure as recommended by Manufacturer. Do not cantilever grating more than 100 mm beyond ends of supports.

3.3. INSTALLATION – ROOF GUARDRAIL

- .1 Install roof guardrails in accordance with Manufacturer's written instructions and approved Shop Drawings. Do not penetrate metal roofing. Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage, and installation instructions.
- .2 Coordinate installation of anchorage for walkways and guardrails. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Space anchors as determined by manufacturer to achieve solid attachment to existing structure.
- .4 Align assembly and install plumb and level, square, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Install guardrails in proper relation to adjoining construction. Do not twist or force fit into poorly prepared openings. Install guardrails level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to other adjacent construction. Maintain dimensional tolerances and alignment with adjacent work.

3.4. CLEANING

- .1 Remove markings from finished surfaces.
- .2 Remove and dispose of excess materials from site on completion.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Fire stop Systems.

1.2 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with

specifications for specified performance characteristics and physical properties.

- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company specializing in fire stopping installations approved by manufacturer.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative DCC Representative.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building sub-trades.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stop system rating: 1 hour.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by DCC Representative.
- .2 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify DCC Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 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 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.
 - .8 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

Part 1 - General

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C 919-12, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .2 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .3 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).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00 - Submittals.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each color where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00 – Submittal Procedures.
- .7 Instructions to include installation instructions for each product used.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with manufacturer's recommendations.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals

and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

- .1** When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
- .2** When joint substrates are wet.

.2 Joint-Width Conditions:

- .1** Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

- .1** Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1** Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2** Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3** Ventilate area of work as directed by the DCC Representative by use of acceptable portable supply and exhaust fans.

Part 2 - Products

2.1 SEALANT MATERIALS

- .1** Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2** When low toxicity caulks are not possible, confine usage to areas which 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** Exterior sealants: A One Part Silicone Building Sealant that cures in the presence of atmospheric moisture to produce a durable, fire-resistant, flexible and ultra-low-modulus silicone rubber joint seal.
- .2** Silicones One Part.
 - .1** To CAN/CGSB-19.13.
- .3** Acrylic Latex One Part.

- .1 To CAN/CGSB-19.17.
- .4 Acoustical Sealant.
 - .1 To ASTM C 919.
- .5 Other interior sealants:
 - .1 A One Part Silicone Building Sealant that cures in the presence of atmospheric moisture to produce a durable, fire-resistant, flexible and ultra-low-modulus silicone rubber joint seal
 - .2 A multi-component, chemically-curing, gun-grade, polyurethane sealant
- .6 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
 - .3 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast, masonry): Sealant type: Exterior Sealant.
- .2 Control and expansion joints in exterior surfaces of unit masonry walls: Sealant type: Exterior Sealant.
- .3 Coping joints and coping-to facade joints: Sealant type: Exterior Sealant.
- .4 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: Interior Sealant.
- .5 Interior control and expansion joints in floor surfaces: Sealant type: Interior Sealant to be compatible with finished flooring manufacturer's written specifications.
- .6 Perimeters of interior hollow metal frames, as detailed and itemized: Sealant type: latex.
- .7 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant type: Interior Sealant.
- .8 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Sealant type: Interior Sealant.
- .9 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant type: clear silicone.
- .10 Exposed interior control joints in drywall: Sealant type: Interior Sealant.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

- .2 Primer: as recommended by manufacturer.

Part 3 - Execution

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.

- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place. .
- .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant

END OF SECTION

Part 1 General

1.1 Summary

- .1 As indicated in Door Schedule, supply and installation of following doors:
 - .1 Fire rated (labeled) and non-rated steel frames.
 - .2 Swing type flush doors as follows:
 - .1 Interior Hollow Metal Door - Fire rated
 - .2 Interior Hollow Metal Door - Non-rated,
 - .3 Exterior Insulated Hollow Metal Doors

1.2 RELATED SECTIONS

- .1 Section 07 92 00 – Joint Sealants
- .2 Section 08 71 00 – Door Hardware
- .3 Section 09 21 16 – Gypsum Board Assemblies
- .4 Section 09 22 16 – Non-Structural Metal Framing

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-17, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-13/G40.21-13, 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, 2006.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80-2016, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-2017, Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

- .3 CAN/ULC-S705.2-20 , Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

1.4 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 NFPA 252 for ratings specified or indicated.
 - .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E152, NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Receive and store materials as recommended by materials manufacturer.
- .2 Storage and Handling Requirements:
 - .1 Adequately protect surfaces from damage during moving, handling and storage.

1.6 QUALITY ASSURANCE

- .1 Manufacture fire door and frame components and assemblies to ULC/ULI/Warnock Hersey/Factory Mutual requirements
- .2 Testing Agencies: Provide doors produced under label service program of a testing agency acceptable to Authorities Having Jurisdiction, and as follows:
 - .1 Steel Fire Rated Doors and Frames: Labelled and listed by organization accredited by Standards Council of Canada for ratings specified or indicated.
 - .2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:
 - .1 List by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by agency to individual manufacturers.
 - .2 Fabricate rated doors, frames, and screens to labelling authority standard.
 - .3 Affix appropriate label to each opening requiring indicating a labelling requirement.

1.7 SUBMITTALS

- .1 Submit shop drawings:
 - .1 Provide elevations of each door and frame. Indicate details of internal reinforcement, anchor types, closure methods, and location of cut-outs for hardware.
 - .2 Indicate each type of: door material, metal core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware. Indicate factory finishes. Indicate fire rating for each door.

- .3 Indicate each type frame material, core thickness, reinforcements, location of anchors and exposed fastenings and reinforcing. Indicate finishes. Indicate Fire Rating for each frame type.
- .2 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .3 Submit Test Reports indicating compliance with fire ratings for door and frame assemblies.
- .4 Submit contract hardware list. Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information. Submit manufacturer's instructions, printed product literature and data sheets for door hardware. Include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 MATERIALS

- .1 Sheet Steel: ASTM A653M commercial quality steel, cold rolled, zinc coated as indicated.
- .2 Accessories: Glazing stops, floor anchors, channel spreaders, 1.6 mm tee anchors, 1.2 mm wall stud anchors, zinc coated to ASTM A653M, coating designation ZF075 Drill stud anchors for wire tie to studs.
- .3 Guard Boxes: 0.50 mm steel, ZF075 coating designation zinc finish to ASTM A653M.
- .4 Frame Reinforcement for Hardware: carbon steel, prime painted, to the following thicknesses:
 - .1 Hinge & Pivot reinforcements : 30 mm x 250 mm: 3.5 mm
 - .2 Strike reinforcements: 1.6 mm
 - .3 Flush Bolt reinforcements: 1.6 mm
 - .4 Closer reinforcements: 2.5 mm
 - .5 Surface hardware reinforcements: 2.5 mm
 - .6 Door Jamb Reinforcement: 100 mm x 40 mm structural steel channel to CAN3-G40.21.
- .5 Reinforcement for Hardware: carbon steel, welded in place, prime painted, to the following thicknesses:
 - .1 Hinge, pivot and panic bar reinforcements: 3.5 mm
 - .2 Lock face, flush bolts, concealed bolts: 2.5 mm
 - .3 Concealed or surface closer reinforcements: 2.5 mm
 - .4 Other surface hardware reinforcements: 2.5 mm
- .6 Additional Door and Frame Reinforcing
 - .1 Other reinforcing as required by RCMP G13-01

2.2 DOOR CORE MATERIALS

- .1 Interior:
 - .1 Stiffened: face sheets welded, honeycomb core.
- .2 Exterior:
 - .1 Polyurethane core: to CAN/ULC S704, rigid modified poly/isocyanurate, closed cell board. Density 32 kg/m³. Thermal value: RSI 1.0.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
 - .1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.
- .2 Polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 FINISHING

- .1 Primer: Touch-up prime CAN/CGSB-1.181. Maximum VOC limit 50 g/L to GC-03, verify compatibility with finish paint
- .2 Paint: Site paint steel doors and frames in conformance with Section 09 91 00.
 - .1 Protect weatherstripping from paint. Provide final finish free of scratches or other blemishes.
 - .2 Maximum VOC emission level 50 g/L to GS-11 to SCAQMD Rule 1113.

2.5 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Interior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Metallic paste filler: to manufacturer's standard.
- .4 Door Labels: permanent metal plate. Riveted to door and frame. Indicate manufacturer's name and model number. Indicate Fire resistant rating as indicated on door schedule classification. Indicate door number.
- .5 Perimeter Insulation: spray polyurethane to CAN/ULC-S705.1
- .6 Self-Adhesive Air/Vapour Barrier Membrane: SBS modified asphalt with cross laminated polyethylene face. Used as transition between door frame and existing vapour barrier.
 - .1 Properties:
 - .1 Thickness: 1.0 mm
 - .2 Water vapour permeance (ASTM E96/E96M): 1.7 ng/Pa.m.s
 - .3 Air permeability (ASTM E283): < 0.002 L/sec. m² @ 75 Pa.
 - .4 Flexibility at cold temperature: -30°C
 - .5 Static puncture - membrane: 178 N.

- .6 Elongation: 200%.
 - .7 Moisture absorption: 0.1%.
 - .8 Lap adhesion: >4200 N/m
- .7 Sealant: As per Section 07 92 00 – Joint Sealants.
- .8 Glazing: as per Section 08 87 23.16.

2.6 DOOR FRAME ANCHORAGE

- .1 Provide anchorage to floor and wall construction to meet the performance requirement of the intended use of room
- .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.

2.7 DOOR FRAMES FABRICATION

- .1 Fabricate frames in accordance with CSDMA specifications unless indicated otherwise in Door Schedule.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Frames:
 - .1 1.6 mm thermally broken steel for exterior locations, hot dip galvanized to ASTM A653.
 - .2 1.6 mm for interior locations, zinc coated to ZF075 for interior frames
- .4 Mortise, reinforce, drill and tap frames and reinforcements to receive hardware using templates provided. Locate mortising to CSDMA requirements.
- .5 Install 2 double stud bumpers on strike jamb of frame for each single door and 2 bumpers at head of double door frames.
- .6 Protect strike, hinge reinforcement completely by guard boxes welded to frame.
- .7 Attach temporary wood spreaders to frame; ensure proper frame alignment.
- .8 Where frames terminate at finished floor, provide floor plates for anchorage to floor structure.
- .9 Insulate exterior frame components with polyurethane insulation.
- .10 Cut mitres accurately and weld on inside of frame profile.
- .11 Grind welded corners to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .12 Fill surface depressions and butted joints with metallic paste filler and sand to a uniform smooth finish.
- .13 Touch-up frames by priming areas where galvanizing is damaged.

- .14 Reinforce head of frames wider than 1200 mm with 2.5 mm formed steel channel welded in place, flush with top of frame.
- .15 Provide three jamb anchors per jamb for frames up to 2130 mm high and one additional for each 600 mm over 2130 mm high.

2.8 THERMALLY BROKEN DOORS AND FRAMES

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19M.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

2.9 DOOR FABRICATION

- .1 Hollow metal doors shall be of seamless construction with no visible seams or joints on faces at vertical edges.
- .2 Doors: 1.6 mm for interior locations; zinc coated to ZF075 for interior frames.
- .3 Core Construction shall be one of the following:
 - .1 Exterior Doors: Internally steel stiffened with continuous vertical steel stiffeners at 150 mm O.C. spot welded to both face sheets; fill voids with polyurethane insulation.
 - .2 Interior Doors: Internally steel stiffened with continuous vertical steel stiffeners at 150 mm O.C. spot welded to both face sheets; fill voids with honeycomb core.
- .4 Refer to door schedule for required classes and ratings of fire doors, glazing or other requirements.
- .5 Mortise, reinforce, drill and tap doors and reinforcements to receive hardware using templates provided.
- .6 Join door faces at intersecting edges with continuous welds, fill and grind smooth. Add additional reinforcing as required for doors requiring higher impact intrusion protection.
- .7 Finish door faces flush without visible joints or distortion.
- .8 Close top and bottom edges of door with recessed minimum thickness 1.2 mm steel channel, full width welded. Make provisions for glass, provide glazing stops. Weld stops to door on security side.
- .9 Touch-up doors by priming areas where zinc coating is damaged.
- .10 Provide welded astragal on operable doors for pairs of doors, other door to be fixed, flush bolted top and bottom as indicated in Hardware schedule in Section 08 71 00.
- .11 Profile edge of doors as follows: Single acting swing doors - Bevel 3 mm in 50 mm
Double acting swing doors - Radius of 54 mm.

2.10 HOLLOW STEEL CONSTRUCTION

- .1 Form face sheets for interior doors from 1.6mm sheet steel.

- .2 Reinforce doors with vertical stiffeners, securely welded to each face sheets at 150 mm on centre maximum.

2.11 HARDWARE

- .1 Prepare doors and frames to receive hardware.
- .2 Blank, reinforce, drill and tap doors and frames for mortised, templated hardware. Prepare for electronic hardware. Use templates provided by finish hardware supplier.
- .3 Reinforce doors and frames where required for concealed or surface mounted hardware.
- .4 General: Prepare for hardware items as specified including: lock and latch sets, exit devices, power controllers, custom EOL resistors, automatic door operators and hardware. Prepare doors and frames as follows:
 - .1 Heavy duty butt hinges. Template hinges, 3 or 4 as required.
 - .2 ANSI strike.
 - .3 Reinforcing at head for door closer.
 - .4 Hole: 19 mm diameter for contact.
 - .5 Auxiliary deadbolt.
 - .6 Guard boxes at strike and hinge locations.
 - .7 Power box at head.
 - .8 Protect mortised cut-outs with steel guard boxes.
 - .9 Provide three single silencers for single doors on strike side.
 - .10 Threshold: Fire rated, barrier free threshold with interlock channel as indicated in Section 08 71 00.
 - .11 Door Sweep: Fire rated door sweep to work in conjunction with threshold seal
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Prepare doors and frames to accommodate all hardware in compliance with applicable building and fire codes and requirements of local authorities having jurisdiction.

Part 3 Execution

3.1 EXAMINATION

- .1 Prior to installation, remove temporary shipping spreaders.
- .2 Prior to installation, the area of floor on which the frame is to be installed, and within the path of the door swing, shall be checked and corrected for flatness.
- .3 Door and frame product shall be checked for correct size, swing, rating and opening number.
- .4 The supplier shall be advised of any discrepancies prior to installation.

3.2 INSTALLATION

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

- .2 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .3 Install doors and frames to CSDMA Installation Guide.
- .4 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 temporary vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
 - .4 Allow for deflection of structure loads are not transmitted to frames.
 - .5 Tie self-adhesive air/vapour barrier membrane into existing wall assembly vapour membrane to ensure watertightness joint between existing wall and new door frame.
 - .1 Roll entire membrane, firmly and completely as soon as possible to ensure proper contact.
 - .2 Tie membrane into window and door frame interface sheet, to maintain continuity of air/vapour retarder. Position lap seal over firm bearing.
 - .3 Coordinate installation of wall air/vapour retarder with roof vapour retarder to maintain continuity.
 - .4 Ensure minimum of 150mm lap is provided over existing wall vapour barrier.
 - .6 Infill voids between exterior frames and cavity of exterior wall assembly with insulation.
 - .7 Apply sealant to perimeter of frames between frame and adjacent material.
 - .8 Adjust to provide a tight fit at contact points.
 - .9 Adjust for smooth operation and weathertight and secure enclosure.
 - .10 No site alterations to the factory fabricated units will be permitted.
 - .11 Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more than ± 1.5 mm in compliance with HMMA 841.
- .5 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 floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latch side and head: 1.5 mm.
 - .3 Finished floor, top of carpet, non-combustible sill and thresholds: 13 mm.
 - .3 Adjust operable parts for correct function.

3.3

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.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Co-ordinate submittals with verified field measurements. Confirm actual opening sizes and field conditions before fabrication and co-ordinate with fabrication and construction schedules.
- .3 Submit access door schedule. Include types, locations, sizes, latching or locking provisions. Include other data pertinent to installation.
- .4 Submit product data:
 - .1 Include manufacturer's standard printed product literature for access doors, frames and accessories. Submit catalogue details.
 - .2 Include construction details, fire ratings, materials for individual components. Include profiles and finishes.
 - .3 Include thicknesses and dimensions of individual components and profiles.
 - .4 Include product characteristics, performance criteria, physical sizes.
 - .5 Test reports:
 - .1 Submit documentation and test reports certifying that Fire Rated assemblies are in compliance with UL 10B, NFPA 80, NFPA 252 and NFPA 288.
 - .2 Submit documentation and test reports certifying that acoustical rated assemblies meet the specified ratings when tested to ASTM E90.
- .5 Submit Shop Drawings:
 - .1 Include plans, elevations, sections, details, and attachments to other work.
 - .2 Include details for fabrication of access doors and frames for each type of substrate.
 - .3 Indicate type of door, profiles, dimensions, and methods of assembly.
- .6 Submit manufacturers installation instructions.
- .7 Submit maintenance data for cleaning and maintenance.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's recommendations.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address. Store materials in clean, dry, well-ventilated area. Store and protect access doors from nicks, scratches, and blemishes.
- .3 Apply temporary protective coating to finished surfaces. Remove coating after installation. Do not use coatings that will become hard to remove or leave residue. Leave protective covering in place until final cleaning is completed.

Part 2 Products

2.1 ACCESS DOORS - GENERAL

- .1 Unless indicated otherwise, provide access doors of the following sizes:
 - .1 For body entry: minimum 600 x 600 mm.

2.2 MATERIAL

- .1 Uncoated steel sheet: cold rolled steel sheet to ASTM A1008/A1008M. Grade: Commercial steel (CS). With electrolytic zinc coating to ASTM A879/A879M.
- .2 Hot dip galvanized steel sheet: to ASTM A653/A653M. Grade: Commercial Steel (CS), Type B. Minimum G60 (Z180) or A60 (ZF180) metallic coating.
- .3 Stainless steel plate, sheet, and strip: to ASTM A240/A240M or ASTM A666. Type 304. Remove tool and die marks and stretch lines, or blend into finish. Thickness and finish as specified.
- .4 Aluminum extrusions: to ASTM B221. Alloy 6063.
- .5 Aluminum sheet: to ASTM B209/B209M. Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- .6 Frame anchors: manufacturers standard. Fabricate from same material as door face.
- .7 Fasteners, inserts, bolts, and anchor: manufacturers standard. Hot dip galvanized steel to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

- .1 Provide access door and frame assemblies manufactured as integral units ready for installation.
- .2 Provide additional bracing for larger sizes to add rigidity and prevent sagging.
- .3 Metal: for metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- .4 Doors and frames: grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - .1 For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 - .2 For concealed flanges with plaster bead for full bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- .5 Recessed access doors: form face of door panel to provide recess for application of applied finish. Reinforce door panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
- .6 Latch and lock hardware:
 - .1 Provide the number of latches and locks as required to hold door flush and tightly closed and to provide a smooth uniform appearance.

- .2 Provide all doors with locking mechanisms with replaceable cylinders. Provide manufacturers standard cylinders.
- .3 Prepare doors and frames to accommodate high security lock mechanisms and to accommodate high security cylinders where specified.
- .4 Keys: provide two keys per lock and key all locks alike.

2.4

FINISHES

- .1 Appearance of finished work: visible variations within the same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- .2 Stainless steel finishes:
 - .1 Surface preparation: remove tool and die marks and stretch lines, or blend into finish.
 - .2 Polished finish: to ASTM A480/A480M. Number 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - .3 Run grain of directional finishes with long dimension of each piece.
 - .4 When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- .3 Protective coatings: Apply temporary protective coatings to exposed, factory finished stainless steel. Use only strippable coatings that are easily removable. Leave protective coating in place until final cleaning.

2.5

ACCESS DOORS – FIRE RATED

- .1 Provide fire rated access door assemblies in walls or ceilings that form part of a fire rated enclosure or barrier.
- .2 Design Requirements:
 - .1 Design fire rated access door and frame assemblies to comply with NFPA 80. Products must be listed and labelled by a qualified testing agency for fire ratings indicated.
 - .2 Design fire rated access door assemblies to be installed vertically in a wall in compliance with NFPA 252 or UL 10B.
 - .3 Design fire rated access door assemblies to be installed horizontally in a ceiling in compliance with NFPA 288.
- .3 Fire Rated Wall Access Door: Fire Rated. Flush insulated door with exposed perimeter face flanges. For installation into fire rated, gypsum board or plaster walls and ceiling assemblies.
 - .1 Rating: Minimum 45min. fire resistant rating to CAN/ULC-S104. ULC B rating.
 - .2 Material: Type 304 stainless steel.
 - .3 Frame: 16 gauge stainless steel with 25 mm wide face flange. Equip frame with anchor straps.

- .4 Door panel: 20 gauge stainless steel door with 50 mm thick fire rated insulation. 20 gauge steel back panel to enclose insulation. Fit door flush to frame with reinforced edges. Provide a spring closer to make the door self closing and self latching. Outswinging.
- .5 Latch: universal self latching bolt operated by a flush keyed cylinder. Inside latch release. Lock: prepare for mortised high security compatible cylinder lock assembly. Provide 2 keys per unit. All units keyed alike.
- .6 Hinge: heavy duty, concealed, continuous piano hinge.
- .7 Gasketing: provide optional neoprene gasket around perimeter of door
- .8 Finish: Number 4 satin polished on all exposed surfaces

2.6

FLOOR ACCESS DOORS

- .1 Floor Access Sum Pit: Fire rated. Floor application, recessed access door with flush diamond plate to accommodate thin floor finishes. Designed for flush installation in interior concrete floor assemblies.
 - .1 Fire rating: 1 hours when tested to NFPA 288 and ASTM E119.
 - .2 Design load: minimum live load of 150 pounds per square feet.
 - .3 Frame:
 - .1 Top frame: 75 x 75 x 6 mm thick extruded aluminum angles. Provide thermal break between top and bottom frame components.
 - .2 Bottom frame: 89 x 50 x 11 gauge stainless steel angle.
 - .4 Door panel: 6 mm thick aluminum diamond plate. Reinforced. Square corners. Recess door 3.2 mm to accommodate thin composite floorings such as sheet vinyl or vinyl tile. Door panel opens to 90 degrees.
 - .5 Insulation: 2 layers of 25 mm thick ceramic blanket insulation.
 - .6 Latch: stainless steel slam latch. Provide interior release mechanism. Provide exterior key
 - .7 Operator: provide automatic hold open arm. Provide stainless steel compression springs for lift assistance. Provide UL listed, 165 degrees F fusible link for automatic closing and latching in the event of fire.
 - .8 Hinge: concealed, continuous, heavy duty, Type 316 stainless steel piano hinge.
 - .9 Gasketing: provide optional neoprene gasket around perimeter of door
 - .10 Size: 1600mm x 1200mm.

Part 3

Execution

3.1

MANUFACTURER'S INSTRUCTIONS

- .1 Install door and frame assemblies in accordance with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and data sheets.

3.2 EXAMINATION

- .1 Verify existing conditions before starting work. Verify that rough openings for access door and frame are correctly sized and located. Confirm that blocking, framing and adjoining construction is complete.
- .2 Confirm tolerances and method of attachment with other work. Verify that adjacent materials are compatible with each other.
- .3 Check floor flatness in area and within door swing path. Correct irregularities.
- .4 Proceed with installation only after unacceptable conditions have been corrected.

3.3 INSTALLATION

- .1 Install frames plumb and level in opening. Secure rigidly in place.
- .2 Install access doors to ensure that they are flush with the finished wall or ceiling surface.
- .3 Stud framing. Provide additional steel stud framing all 4 sides for support of access doors. Minimum distance between access door frame and stud: 35 mm. Maximum distance 75 mm.
- .4 Provide access doors for installation by appropriate trades in normally inaccessible ceilings or spaces for servicing valves, joints, traps, motors, starters, fire dampers, balancing dampers, motorized dampers, etc., or for inspection of safety, operating or fire devices.
- .5 Location:
 - .1 Locate access doors where indicated in the drawings.
 - .2 Locate access doors where required to provide convenient access to concealed mechanical or electrical equipment that will require service or maintenance even if not indicated in the drawings.
 - .3 Locate access doors within view of equipment and to ensure equipment is accessible for operating, inspecting, adjusting and servicing without using special tools.
- .6 Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.4 FIELD QUALITY CONTROL

- .1 Inspections:
 - .1 Prepare and submit separate inspection report for each fire rated access door indicating compliance with each item listed in NFPA 80, section 5.2 and NFPA 101.
 - .2 Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
 - .3 Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.5 ADJUSTING

- .1 Adjust operable parts for correct clearances and function. Adjust doors and hardware after installation for proper operation.

- .2 Install and adjust perimeter acoustic seals where indicated. Adjust access door to ensure full and complete compression of acoustical seals at perimeter of the access door.
- .3 Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.6

CLEANING

- .1 Remove factory applied protective coatings from finished surfaces.
- .2 Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7

PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 08 99 - Rough Carpentry for Minor Works
- .2 Section 08 11 00 - Metal Doors and Frames
- .4 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2016, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2017, Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.3-2014, Exit Devices.
 - .4 ANSI/BHMA A156.4-2013, Door Controls - Closers.
 - .5 ANSI/BHMA A156.5-2014, Cylinders and Input Devices for Locks.
 - .6 ANSI/BHMA A156.6-2015, Architectural Door Trim.
 - .7 ANSI/BHMA A156.8-2015, Door Controls - Overhead Stops and Holders.
 - .8 ANSI/BHMA A156.10-2017, Power Operated Pedestrian Doors.
 - .9 ANSI/BHMA A156.12-2018, Interconnected Locks.
 - .10 ANSI/BHMA A156.13-2017, Mortise Locks and Latches.
 - .11 ANSI/BHMA A156.14-2013, Sliding and Folding Door Hardware.
 - .12 ANSI/BHMA A156.15-2015, Closer Holder, Electromagnetic and Electromechanical.
 - .13 ANSI/BHMA A156.16-2018, Auxiliary Hardware.
 - .14 ANSI/BHMA A156.17-2014, Self-closing Hinges and Pivots.
 - .15 ANSI/BHMA A156.18-2016, Materials and Finishes.
 - .16 ANSI/BHMA A156.19-2007, Power Assist and Low Energy Power - Operated Doors.
 - .17 ANSI/BHMA A156.20-2017, Strap and Tee Hinges and Hasps.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .4 After approval samples will be returned for incorporation in Work.
- .4 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Stock Materials:
 - .1 Supply maintenance materials in accordance with Section 01 78 00.
 - .2 Tools:
 - .1 Supply 2 sets of wrenches for and fire exit hardware, door closers and locksets.

1.6 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.

1.7 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 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 indoors, in dry location, off ground 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 strippable coating.
 - .4 Replace defective or damaged materials with new.

Part 2 Products

2.1 HARDWARE ITEMS

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

2.2 DOOR HARDWARE

- .1 Locks and latches:
 - .1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
 - .2 Escutcheons: round.
 - .3 Normal strikes: box type, lip projection not beyond jamb.
 - .4 Cylinders: key into keying system as directed.
 - .5 Finish: See Hardware Schedule.
 - .6 Acceptable Manufacturers:
 - .1 Schlage
 - .2 Assa Abloy/Sargent/Corbin Russwin
 - .3 Stanley Security
- .2 Butts and hinges:
 - .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
 - .2 Acceptable Manufacturers:
 - .1 Dorex
 - .2 Taymor
 - .3 Hager
- .3 Exit devices: to ANSI/BHMA A156.3. Grade 1. See Hardware Schedule for types.
 - .1 Auxiliary item(s):
 - .1 Door co-ordinator, type 21, for pairs of doors with overlapping astragals.
 - .2 Key into keying system as noted as directed by DCC Representative.

- .2 Acceptable Manufacturers:
 - .1 Saregnt
 - .2 Corbin Russwin
 - .3 Von Duprin
- .4 Door Closers and Accessories:
 - .1 Door controls (closers): to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1, finished to Hardware Schedule.
 - .2 Closer/holder release devices: to ANSI/BHMA A156.15, designated by letter C and numeral identifiers listed in hardware schedule.
 - .3 Door co-ordinator: surface for pairs of doors with overlapping astragal.
 - .4 Acceptable Manufacturers:
 - .1 LCN
 - .2 Sargent
 - .3 Norton
- .5 Auxiliary hardware: to ANSI/BHMA A156.16, as listed below and listed in Hardware Schedule.
 - .1 Door silencer: Rubber
 - .2 Kick Plate: See Hardware schedule
- .6 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene weather seal, surface mounted with drip cap, closed ends, adjustable, clear anodized finish.
- .7 Thresholds: extruded aluminum, surface, serrated, with thermal break of rigid PVC.
- .8 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and closed cell neoprene insert, clear anodized finish.
 - .2 Adhesive backed neoprene material.
 - .2 Door bottom seal/Door Sweep:
 - .1 Extruded aluminum frame and closed cell neoprene sweep, clear anodized finish.
- .9 Astragal: overlapping, extruded aluminum, frame with vinyl insert, finished to match doors.

2.3 MISCELLANEOUS HARDWARE

- .1 Indexed key control system: to ANSI/BHMA A156.5, designated by letter E and numeral identifiers.

2.4 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.

2.5 KEYING

- .1 Doors to be master keyed. Prepare detailed keying schedule in conjunction with DCC Representative.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply construction cores.
- .6 Hand over permanent cores and keys to DCC Representative.
- .7 All service rooms to be keyed to master key system. Final locksets for these rooms will be supplied and installed by CFB Borden at time of substantial completion. Contractor must furnish construction locksets which will be removed at substantial completion.

Part 3 Execution

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .5 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 DCC 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.
 - .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.

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 DCC 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 and fire exit hardware and locksets.
- .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.

3.6 SCHEDULE

.1 Hardware Set #1

1 Pair of Doors D-123B, WASTEWATER STORAGE ROOM TO EXTERIOR LHR/
RHRA

Type: DE-2, 910, 910 x 2150 x 45 – IN HM DR x TB HM FR

1 Pair of Doors D-123A, WASTEWATER STORAGE ROOM TO EXTERIOR LHR/
RHRA

Type: DE-2, 910, 910 x 2200 x 45 – IN HM DR x TB HM FR

2	Cont. Hinge	661 HD UL x Dr Ht	AL
1	SVR Exit Device	2201	630
1	SVR Exit Device	2203 x 1703	630
1	Rim Cylinder	12E72 (Pat.)C4RP	626
2	Door Closer	D-4551 EDA	AL
2	Concealed Stop	910 S	626
2	Kick Plate	K10F 200 x Size to Suit (SM)	679
1	Astragal	W-25 x Door Ht	CA
1	Weather Seal	W-14 (2 x H, 1 x W)	CA
2	Door Sweep	W-24S x Dr Width	CA
1	Frost Threshold	CT-45A x Opening Width	

"Above" Notes: KICK PLATES ON INTERIOR SIDE ONLY

.2 Hardware Set #2

1 Single Door D-109A, CORRIDOR 100B TO WOMEN'S W.R. & LOCKER ROOM
RH

Type: DE-1, 910 x 2135 x 45 – HM DR x HM FR

3	Hinge	CB179 114mm x 101mm	675
1	Pushplate	K11A-6 125mm x 700mm	679
1	Pull	2012-2 x TB	679
1	Door Closer	D-4551 REG	AL
1	HD Wall Stop	S121	675
2	Kick Plate	K10F 200 x Size to Suit (SM)	679

"Above" Notes: KICK PLATES ON BOTH SIDES

.3 Hardware Set #2.1

1 Single Door D-104A, CORRIDOR 100B TO MEN'S W.R. & LOCKER ROOM RH

Type: DE-1, 910 x 2135 x 45 – HM DR x HM FR

3	Hinge	CB179 114mm x 101mm	675
1	Pushplate	K11A-6 125mm x 700mm	679
1	Pull	2012-2 x TB	679
1	Door Closer	D-4551 REG	AL
1	HD Wall Stop	S121	675
2	Kick Plate	K10F 200 x Size to Suit (SM)	679
1	Surface Door Bottom	CT-52 x Dr Width	CA

"Above" Notes: KICK PLATES ON BOTH SIDES

.4 Hardware Set #3

1 Single Door D-104B, CORRIDOR 100B TO MEN'S W.R. & LOCKER ROOM LH

1 Single Door D-109C, CORRIDOR 100B TO WOMEN'S W.R. & LOCKER ROOM LH

Type: DE-1, 910 x 2135 x 45 – HM DR x HM FR

3	Hinge	CB179 114mm x 101mm	675
1	Pushplate	K11A-6 125mm x 700mm	679
1	Pull	2012-2 x TB	679
1	Door Closer	D-4551 REG	AL
1	HD Wall Stop	S121	675
2	Kick Plate	K10F 200 x Size to Suit (SM)	679

"Above" Notes: KICK PLATES ON BOTH SIDES

.5 Hardware Set #3.1

1 Single Door D-M-1F, CORRIDOR 100B TO MECH ROOM LH

1 Single Door D-121A, CORRIDOR 100C TO COMPOSITE DIRTY ROOM LH

1 Single Door D-121B, CORRIDOR 100C TO COMPOSITE DIRTY ROOM LH

1 Single Door D-122B, COMPOSITE DIRTY ROOM TO COMPOSITE DIRTY ANNEX RH

1 Single Door D-SAS, EXIST. MEZZANINE ROOM TO SERVICE ACCESS SPACE LHR

Type: DE-1, 910 x 2135 x 45 – HM DR x HM FR – 45 MIN. F.R.R.

3	Hinge	CB179 114mm x 101mm	675
1	Classroom Lockset	9K 3 (Pat.) 7 D 14 D	626

1	Door Closer	D-4551 REG	AL
1	HD Wall Stop	S121	675
1	Kick Plate	K10F 200 x Size to Suit (SM)	679

.6 Hardware Set #4

1 Single Door D-109B, VESTIBULE TO WOMEN'S W.R. & LOCKER ROOM RHR
Type: DE-1, 910 x 2135 x 45 – HM DR x HM FR

3	Hinge	CB179 114mm x 101mm	675
1	Pushplate	K11A-6 125mm x 700mm	679
1	Pull	2012-2 x TB	679
1	Door Closer	D-4551 REG	AL
1	HD Wall Stop	S121	675
2	Kick Plate	K10F 200 x Size to Suit (SM)	679

"Above" Notes: KICK PLATES ON BOTH SIDES

.7 Hardware Set #5

1 Single Door D-100B1, CORRIDOR TO EXTERIOR RH
Type: DE-1, 910 x 2135 x 45 – IN HM DR x TB HM FR

1 Single Door D-122A, COMPOSITE DIRTY ANNEX TO EXTERIOR LHR/ RHRA
Type: DE-1, 910 x 2200 x 45 – IN HM DR x TB HM FR

3	Heavy Duty Hinge	FB168 114mm x 101mm	675
1	Exit	2403 x 2003C	630
1	Mortise Cylinder	1E74 (Pat.) C4RP	626
1	Door Closer	D-4551 REG	AL
1	Concealed Stop	910 S	626
1	Kick Plate	K10F 200 x Size to Suit (SM)	679
1	Weather Seal	W-14 (2 x H, 1 x W)	CA
1	Door Sweep	W24S x Dr Width	CA
1	Frost Threshold	CT-45A x Opening Width	

"Above" Notes: KICK PLATES ON INTERIOR SIDE ONLY

.8 Hardware Set #6

1 Pair of Doors D-100B2, CORRIDOR 100A TO CORRIDOR 100B LHR/RHA
Type: DE-3, 810, 810 x 2135 x 45 – HM DR x HM FR

6	Heavy Duty Hinge	FB168 114mm x 114mm	675
2	Exit Device	98-49-TL-BE-626-3'-LHR-LBL-626-07-HM-D	
2	Overhead Door Stop	903S - Surface Mounted	630
4	Kick Plate	K10A (200 x 800) TM	630
2	Astragal	By Door Supplier (Locate on Pull Side of Door)	
1	Weatherstripping	W63 x 6m (perimeter of frame)	Black
2	Door Sweep	293100_NB	CA
2	Door Silencer	SR64	GREY

.9 Hardware Set #7

1 Single Door D-111, CORRIDOR 100A TO BARRIER-FREE WASHROOM LH

Type: DE-1, 910 x 2135 x 45 – HM DR x HM FR – 45 MIN. F.R.R.

3	Standard Hinge	CB179 114mm x 101mm	675
1	Storeroom Lockset	45H 7D 14H 626 LHR	626
1	Mortised Cylinder Housing	1E74 x Cam to Suit	626
1	Construction Core	ICX -7 Pin	626
1	Permanent Core	ICM - 7 Pin	626
1	Electric Strike	BES-F2164	679
1	Auto Operator	D-4990 PUSH SIDE	689
1	WR Relay Kit	CX-WC13XSM-FE	
1	WR Emerg. Call Kit	CX-WEC10-K2-FE	
1	Kick Plate	K10F 200 x Size to Suit (SM)	679
1	Mop Plate	K10F 101 x Size to Suit x TM	679
3	Door Silencer	SR64	GRY

.10 Hardware Set #8

1 Single Door D-100C, CORRIDOR 100C TO PAINT BOOTH RHR

Type: DE-1, 910 x 2135 x 45 – HM DR x HM FR – 45 MIN. F.R.R.

3	Standard Hinge	CB179 114mm x 101mm	675
1	Exit	FL2408 x 2908B x S300	630
1	Door Closer	D-4551 REG	AL
1	HD Wall Stop	S121	675
2	Kick Plate	K10F 200 x Size to Suit (SM)	679
1	Surface Door Bottom	CT-52 x Dr Width	CA
1	Threshold	CT-10 x Opening Width	

“Above” Notes: KICK PLATES ON BOTH SIDES

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 08 11 00 - Metal Doors and Frames

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C1651-11 – Standard Test Measurement of Roll Wave Optical Distortion in Heat-Treated Flat Glass.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Shop Drawings: Indicate each Glass Type including locations. Provide scaled elevations for each location. Indicate glass thicknesses, sizes and profiles, coatings and film types with its location. Indicate stops, trim and junctions with adjacent construction.
- .5 Samples: Submit sample of each glass type specified.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

1.5 QUALITY ASSURANCE

- .1 Certificates: 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.
 - .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 glazing and frames from nicks, scratches, and blemishes.
- .3 Protect prefinished aluminum surfaces with wrapping.
- .4 Replace defective or damaged materials with new.

1.7 AMBIENT CONDITIONS

- .1 Ambient Requirements:
 - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

Part 2 Products

2.1 MATERIALS

- .1 Glazing for Doors:
 - .1 To CAN2 12.1M , transparent, 6 mm thickness, Type 2 tempered or Type 1 laminated, Class B-float, category II, concealed edge.

2.2 ACCESSORIES

- .1 Primer, sealers, cleaners: Types recommended by sealant or gasket manufacturer.
- .2 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, colour black.
- .3 Glazing clips: manufacturer's standard type.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
 - .1 Verify that openings for glazing are correctly sized and within tolerance.
 - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
 - .3 Visually inspect substrate in presence of DCC Representative.
 - .4 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

3.2 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.

- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 11. Leave Work area clean at end of each day.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape.
- .3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 74 11 - Cleaning

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C475-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C840-18a, Standard Specification for Application and Finishing of Gypsum Board.
 - .3 ASTM C1002-18, 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.
 - .4 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .5 ASTM C1178/C1178M-18, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
 - .6 ASTM C1396/C1396M-17, Standard Specification for Gypsum board.
- .2 Association of the Wall and Ceilings Industries International (AWCI)
 - .1 AWCI Levels of Gypsum Board Finish-GA-214-2017.
- .3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, 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 Shop Drawings:
 - .1 Submit gypsum board assembly drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .2 Indicate components such as fastener type, dimensions, spacing and locations at gypsum board edges, ends and in field of board as well as installation methods. Components and work to confirm to ASTM C 840 standard specification for application and finishing of gypsum board.
 - .3 Indicate type of joint compound, and number of joint compound layers.
 - .4 Indicate number and location of electrical boxes for wall and ceiling.
- .4 Samples:
 - .1 Submit for review and acceptance of each component specified or necessary for complete installation. Include technical descriptive data.
 - .2 Samples will be returned for inclusion into work.
- .5 Certifications:
 - .1 Submit certificates signed by manufacturer certifying that materials comply 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 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 and applicable standard designation.
- .3 Exercise care in unloading gypsum board materials shipment to prevent damage.
- .4 Storage and Handling Requirements in accordance with ASTM C 840–16:
 - .1 Store gypsum board assemblies materials level flat, in dry location, off ground, indoors 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 gypsum board from direct exposure to rain, snow, sunlight, or other excessive weather conditions.
 - .4 Protect ready mix joint compounds from freezing, exposure to extreme heat and direct sunlight.
 - .5 Protect from weather, elements and damage from construction operations.
 - .6 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .7 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
 - .8 Replace defective or damaged materials with new.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature 10 °C minimum, 21 °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, clean, 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.

Part 2 Products

2.1 MANUFACTURERS

- .1 Acceptable Material: Solid surfacing material of this section is based on listed manufactures, which has been selected to establish a standard of acceptance with respect to design, function, quality, colour, pattern, final texture, finished appearance and finish. For substitution materials, submit completed form DCL242 along with technical literature to DCC Representative for review and acceptance.

2.2 MATERIALS

- .1 Regular Gypsum Board (GB-1): Meeting requirements of ASTM C1396M; having mould resistance facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273 with Long edges tapered.
- .2 Fire Resistant Rated Gypsum Board (GB-2): Meeting requirements of ASTM C1396M and complies with Type X requirements; having mould resistance facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273 with Long edges tapered.
- .3 Moisture and Mold Resistant Gypsum Board (GB-3): Meeting requirements of ASTM C1396M, gypsum core panel with enhanced core formulated for resistance to moisture and mold; having mould resistance facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273. Meeting requirements of ASTM C1396M.
 - .1 Acceptable Materials:
 - .1 CertainTeed, M2Tech Moisture & Mold Resistant Gypsum Board
 - .2 CGC Fibreock
 - .3 Georgia Pacific ToughRock Mold-Guard
- .4 Fire Rated Moisture and Mold Resistant Gypsum Board (GB-4): Meeting requirements of ASTM C1396M, gypsum core panel with enhanced core formulated for resistance to moisture and mold; for use in fire-resistant Type X designs, having mould resistance facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273.
 - .1 CertainTeed, M2Tech Type X Moisture & Mold Resistant Gypsum Board
 - .2 CGC Fiberock Aqua-Tough AR interior Panel

- .3 Georgia Pacific ToughRock FireGuard X Mold-Guard
- .5 Mould and Mildew Resistant Tile Backer (GB-5): Glass mat faced gypsum board meeting requirements of ASTM C1178/1178M; with mould resistant facers meeting rating of 10 (zero mould growth) in accordance with ASTM D3273; with long edge tapered; nominal thickness indicated on Drawings.
 - .1 Acceptable Materials:
 - .1 CertainTeed Diamondback GlasRoc Tile Backer
 - .2 CGC Fibreock Aqua-Tough Tile Backer
 - .3 Georgia Pacific DensShield Tile Backer
- .6 Fire Resistant, Mould and Mildew Resistant Tile Backer (BB-6): Glass mat faced gypsum board meeting requirements of ASTM C1178/1178M, Type X; with mould resistant facers meeting rating of 10 (zero mould growth) in accordance with ASTM D3273; with long edge tapered; nominal thickness indicated on Drawings.
 - .1 Acceptable Materials:
 - .1 CertainTeed Diamondback GlasRoc Tile Backer Type X
 - .2 CGC Fibreock Aqua-Tough Tile Backer Type X
 - .3 Georgia Pacific DensShield FireGuard Tile Backer
- .7 Ceiling metal furring runners, hangers, tie wires, inserts, and anchors: to ASTM C754
- .8 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .9 Steel drill screws: to ASTM C1002.
- .10 Stud adhesive: to CAN/CGSB-71.25.
- .11 Laminating compound: as recommended by manufacturer, asbestos-free.
- .12 Joint Treatment Materials: Provide joint compound and accessory materials in accordance with ASTM C475/C475M; for each coat use formulation that is compatible with other compounds applied on previous or for successive coats, and as follows:
 - .1 Pre-Filling: Setting type taping compound.
 - .2 Embedding and First Coat: Drying type compound.
 - .3 Fill Coat: Drying type compound.
 - .4 Finish Coat: Drying type, sandable topping compound.
- .13 Joint Compound for Interior Mould and Moisture Resistance Gypsum Board: Provide Joint compound and accessory materials in accordance with ASTM C475/C475M; for each coat use formulation that is compatible with other compounds applied on previous or for successive coats and as follows:
 - .1 Pre-Filling: Setting type taping compound.
 - .2 Embedding and First Coat: Drying type compound.
 - .3 Fill Coat: Drying type compound.

2.3 ACCESSORIES

- .1 Interior Trim: Galvanized coated steel sheet or rolled zinc meeting requirements of ASTM C1047, in the following shapes:
 - .1 CB Corner Bead: Standard 0.40 mm nominal thickness, corrosion resistant outside corner reinforcement, angle to suit installation.
 - .2 Reinforced Corner Bead: Heavy Duty 0.45 mm nominal thickness, corrosion resistant outside corner reinforcement for use at high exposure corners, able to suit installation.
 - .3 LC Edge Bead: U-shaped trim 0.40 mm thickness to provide a clean finish edge; exposed long flange receives joint compound; use at exposed panel edges, and returns to adjacent materials.
 - .4 Expansion Joints: Back-to-back edge bead at joints spanning building expansion and movement joints.
 - .5 Strippable Edge Trim: Extruded PVC with pre-masked L-shaped tape on trim with tear away protective serrated strip for removal after compound and paint is applied, for use at areas where gypsum board butts window frames and where gypsum butts concrete.
 - .6 Firestopping: In conformance with Section 07 84 00.
 - .7 Ceiling Access Doors and Panels: Architectural access panel with concealed hardware (frame, latch and hinge), and gypsum board inlay; fully removable panel with safety cables; Size as indicated.

Part 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 DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 ERECTION

- .1 Do application and finishing of gypsum board to ASTM C840-16 except where specified otherwise.
- .2 Do application of gypsum sheathing to ASTM C1280-13a.
- .3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840-16 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 C840-16, except where specified otherwise.
- .11 Furr openings and around built-in equipment, cabinets and access panels.
- .12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .13 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 have been approved.
- .2 Apply single layer gypsum board to 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 C840-16.
 - .2 Apply gypsum board on walls vertically or horizontally, providing sheet lengths that will minimize number of board edges or end joints.
- .3 Apply single layer gypsum board to concrete block surfaces, where indicated, using laminating adhesive.
 - .1 Comply with gypsum board manufacturer's recommendations.
 - .2 Brace or fasten gypsum board until fastening adhesive has set.
 - .3 Mechanically fasten gypsum board at top and bottom of each sheet.
- .4 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.
- .5 Apply water-resistant gypsum board where indicated. 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.

- .6 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.
- .7 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .8 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.
- .9 Install gypsum board with face side out.
- .10 Do not install damaged or damp boards.
- .11 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. Secure using contact adhesive for full length at 150 mm on centre.
- .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. Minimize joints; use corner pieces and splicers.
- .6 Construct control joints of two back-to-back casing beads 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 at changes in substrate construction, at approximate 15 m spacing on ceilings and at approximate 10 m spacing on long corridor runs.
- .9 Install control joints straight and true.
- .10 Ensure that screws or nails are properly applied in process of attaching gypsum board to framing without damaging of gypsum board edges and ends.
- .11 Construct expansion joints at building expansion and construction joints. Provide continuous dust barrier.

- .12 Install expansion joint straight and true.
- .13 Install cornice cap where gypsum board partitions do not extend to ceiling.
- .14 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at 300 mm on centre.
- .15 Splice corners and intersections together and secure to each member with 3 screws.
- .16 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .17 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.
- .18 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 0: no tapping, finishing or accessories required.
 - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .5 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.
 - .6 Level 5: 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; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- .19 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.
- .20 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board, invisible after surface finish is completed.
- .21 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .22 Completed installation smooth, level or plumb, free from waves and other defects and ready for surface finish.

- .23 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .24 Mix joint compound slightly thinner than for joint taping.
- .25 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .26 Allow skim coat to dry completely.
- .27 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.

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

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 06 08 99 - Rough Carpentry for Minor Works
- .4 Section 09 21 16 - Gypsum Board Assemblies

1.2 DESIGN REQUIREMENTS

- .1 Design complete framing system to obtain a maximum allowable deflection of L/360 with a horizontal Design load of 240Pa unless otherwise indicated. Maximum Stud spacing 600 mm OC. Design system with lightest possible gauge studs including floor and ceiling tracks, anchors and related components. Design in accordance with manufacturer's published design guides to obtain a maximum deflection criteria in consideration of maximum framing height limits.
- .2 Stud Table.

Stud Size (mm)	Thickness (mm)	Gauge (mm)	Gypsum Board		
			1 layer	2 layers	3 layers
			Max vertical span unreinforced (mm)		
41	0.46	25	2900	3200	2510
64	0.46	25	3810	4110	3350
64	0.84	20	4270	4500	3960
92	0.46	25	4880	5100	4420
92	0.84	20	5560	5760	5260
152	0.46	25	6090	6090	6090
152	0.84	20	8080	8380	7770

- .3 For interior Heavy Gauge wall framing systems which will receive 19 and 32 mm thick stone cladding, design complete framing system to obtain a maximum allowable deflection of L/720 with a horizontal Design load of 500Pa, at straight and curved sections. Design system with lightest possible stud sizes, gauges, spacing, tracks and side clips, anchors and related components. Design in accordance with stone cladding and cement board manufacturers' published design guides to obtain a maximum deflection criteria in consideration of maximum framing height limits.

1.3 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide Manufacturer's Product data sheets for each component.
- .3 Provide Shop Drawings. Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors. Indicate locations, dimensions, openings and requirements of related work.
- .4 Indicate thickness and profile for each component. Indicate deflection limit and design limit for each stud size and each gauge of stud used. Indicate maximum design height and stud spacing for each stud size and each gauge. Provide table indicating which stud size and gauge is used for each Wall Type as listed in the Drawings.
- .5 Provide Manufacturer's Design tables for all components. Indicate the construction for each wall assembly including: stud size, gauge, spacing, horizontal reinforcing, number and type of GWB panels applied to each face, type of cavity insulation, STC rating and Fire Resistance Rating.
- .6 Provide duplicate 300 mm long samples of each component. Provide samples in all specified thicknesses.

1.4 QUALITY ASSURANCE

- .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties. Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 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.

Part 2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C645, 41, 64, 92 and 152 mm stud size. Roll formed from 0.84 mm minimum base steel thickness, (20 gauge) and from 0.46 mm minimum base steel thickness, (25 gauge) hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
- .2 Heavy Gauge channel stud framing: to ASTM C645. Stud size as indicated in the drawings and Schedule. Studs: 1.44 mm (16 gauge) unless indicated otherwise. Floor and ceiling track. 1.62 mm (15 gauge) with 50 mm flange height unless indicated otherwise. Bridging

channel: 1.44 (16 gauge) x 38 mm width unless indicated otherwise. Bridging clips: 1.44 (16 gauge) x 38 mm legs x width to suit studs unless indicated otherwise.

- .1 Refer to Schedule for descriptions of Heavy Gauge Wall Assemblies to be installed at certain wall assemblies receiving 19 and 32 mm stone. Refer to drawings for locations.
- .3 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height unless indicated otherwise. Refer to Schedule.
 - .1 Curving floor and ceiling tracks: segmented, sectional, commercial grade top and bottom track. Purpose made for construction of curved wall assemblies. C shaped components with integral locking mechanism in the bottom of the track to secure the individual segments together and lock in the shape of the curve. Complete with integral flexible side straps to allow for curvature indicated on drawings. Commercial steel sheet with ASTM A653, Z180, hot-dip galvanized zinc coating. Properties as follows:
 - .1 Width: to match stud width as indicated in the drawings. Flange height: 50 mm unless indicated otherwise.
 - .2 Minimum base metal thickness: 1.44 mm (16 gauge) unless indicated otherwise.
- .4 Metal channel stiffener: manufacturer's standard sizes, 1.4 mm minimum base steel thickness (16 Gauge) cold rolled steel, coated with rust inhibitive coating. Solid Blocking. 38 mm thick construction grade framing lumber as specified in Section 06 08 99. Width of lumber to suit location and to be sufficient to allow complete attachment of item.
- .5 Plywood Blocking: 15 mm thick G1S DFP plywood as specified in Section 06 08 99 - Rough Carpentry for Minor Works.

2.2 ACOUSTIC ACCESSORIES

- .1 Isolation strip: rubberized, moisture resistant 6 mm thick black closed cell foam, 50 mm wide, with self-adhesive on one face.

Part 3 Execution

3.1 ERECTION

- .1 Install steel stud framing systems in accordance with ASTM C754 and manufacturer's written instructions.
- .2 Install Loadbearing heavy gauge steel stud framing systems as specified in Section 05 41 00 - Structural Metal Stud Framing.

3.2 STEEL STUD INSTALLATION

- .1 Install heavy gauge steel stud framing systems where indicated in the drawings. Install horizontal through the stud bridging channel continuously at maximum 1200 OC vertically to reinforce and stiffen the wall assembly horizontally and axially. Attach horizontal bridging channels to each stud with bridging clips.

- .2 Align partition tracks at floor and ceiling and secure at 600 mm OC maximum.
- .3 Extend partitions full height to structural slab above except where noted otherwise on drawings. Construct full height partitions tight to underside of structure above.
- .4 Construct partitions to finished acoustic ceiling heights where indicated in the drawings.
- .5 Place studs vertically at 600 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .6 Erection tolerances:
 - .1 Plumb: not to exceed 1/500th of member length.
 - .2 Camber: not to exceed 1/1000th of member length.
 - .3 Spacing: not more than 3.0 mm from design spacing.
 - .4 Gap between end of stud and track web: not more than 4.0 mm.
- .7 Attach studs to floor and ceiling track using screws.
- .8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .10 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .11 Install heavy gauge single jamb studs at openings.
- .12 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .13 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .14 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks. Use double track slip joint as indicated.

3.3 BLOCKING

- .1 Install 38 mm thick solid wooden blocking secured between studs for attachment of handrails, washroom fixtures, behind lavatory basins, toilet and washroom accessories, kitchen cabinets, attached millwork, other fixtures including grab bars and towel rails and as indicated. Secure between studs through webs and through face flange of stud.
- .2 Install layer of 15 mm thick plywood to face of steel stud partitions where indicated in the drawings and where required to allow for the future installation of surface mounted equipment and fixtures. Secure plywood directly to face of steel studs, completely covering wall framing. Where plywood is installed to face of steel studs, extend plywood from floor

to ceiling and across the entire wall surface to nearest corner or break in plane in both directions.

- .3 Install layer of 15 mm thick plywood between steel studs where indicated in the drawings and where required to allow for the future installation of surface mounted equipment and fixtures. Secure edges of plywood directly through edge of steel studs. Sizes of plywood blocking to fully support item and to be oversized to accommodate future adjustment of final location.

3.4 FIRESTOPPING

- .1 Co-ordinate installation of Steel Stud Partitions with Section 07 84 00 - Firestopping. Do not proceed with installation of partitions that would interfere with the Firestopping of penetrations through Fire Rated floor or wall assemblies.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00- Common Product Requirements
- .3 Section 07 92 00 - Joint Sealants
- .4 Section 09 21 16 - Gypsum Board Assemblies
- .5 Section 10 21 13.13 - Metal Toilet Compartments
- .6 Section 10 28 00 - Toilet and Bath Accessories

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute
 - .1 ANSI 118.10 - Waterproof Membrane
 - .2 ANSI A137.1:2017 - American National Standards Specifications for Ceramic Tile Revised
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C207-06(2011), Specification for Hydrated Lime for Masonry Purposes.
- .3 International Organization for Standardization (ISO)
- .4 ISO 13007:2014 – Ceramic Tiles – Grouts and Adhesives Part 1
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-2017, Adhesives and Sealants Applications.

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 Ceramic tile, marked to show each type, size, and shape required.
 - .2 Chemical resistant mortar and grout (Epoxy and Furan).
 - .3 Cementitious backer unit.
 - .4 Dry-set cement mortar and grout.
 - .5 Divider strip.
 - .6 Elastomeric membrane and bond coat.
 - .7 Reinforcing tape.
 - .8 Levelling compound.
 - .9 Latex cement mortar and grout.
 - .10 Commercial cement grout.
 - .11 Organic adhesive.
 - .12 Slip resistant tile.

- .13 Waterproofing isolation membrane.
- .14 Fasteners.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

- .1 Floor tile: Provide two (2) full tiles.

.4 Quality Assurance Submittals:

- .1 Manufacturer's Instructions: manufacturer's installation instructions.
- .2 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 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.

1.5 AMBIENT CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.
- .2 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.6 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.

Part 2 Products

2.1 MANUFACTURERS

- .1 Acceptable Material: Solid surfacing material of this section is based on listed manufactures, which has been selected to establish a standard of acceptance with respect to design, function, quality, performance, colour, pattern, final texture, finished appearance and finish. For substitution materials, submit completed form DCL242 along with technical literature to DCC Representative for review and acceptance.

2.2 MATERIALS

- .1 Floor Tile (CT-1): Slip Resistance: Dynamic C.O.F. - 0.42 wet in accordance with ANSI A137.1

Acceptable Materials:

- .1 Olympia Tile: Kone Series, Pearl – 5978, Size: 305mm x 610mm (12"x24").

- .2 Euro Tile & Stone: Waterfall Series, Colour: Ivory. Size: 305mm x 610mm (12"x24").
- .3 Cera Gres: Built 1/2 Series, Path (White). . Size: 305mm x 610mm (12"x24").
- .2 Wall Tile (CT-2):
Acceptable Materials:
 - .1 Olympia Tile, Kone Series, Pearl – 5978, Size: 305mm x 610mm (12"x24").
 - .2 Euro Tile & Stone: Espada Series, Colour: Artic White. Size: 305mm x 610mm (12"x24").
 - .3 Cera Gres: Gate Series, Colour: Breath, Size: 305mm x 610mm (12"x24").
- .3 Wall Tile (CT-3): Shower walls
Acceptable Material:
 - .1 Olympia Tile, Quebec Series Unglazed, Colour: Pure White FS. Size: 2"x2" Mosaic
 - .2 Euro Tile & Stone: Espada Series, Colour: Artic White. Size: 2"x2" Mosaic
 - .3 Cera Gres: Unit Series, Colour: Super White, Size 2"x2" Mosaic.

2.3 TRIM SHAPES

- .1 Conform to applicable requirements of adjoining floor and wall tile.
- .2 Use slip resistant trim shapes for horizontal surfaces of showers, overflow ledges, recessed steps, shower curbs, drying area curbs, and stools.
- .3 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.
- .4 Internal and External Corners: provide trim shapes as follows where indicated.
 - .1 Bullnose shapes for external corners including edges.
 - .2 Coved shapes for internal corners.
 - .3 Special shapes for:
 - .1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
 - .2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.
 - .3 Wall top edge internal corners to provide integral coved vertical joint with bullnose top edge.
 - .4 Wall top edge external corners to provide bullnose vertical and horizontal joint edge.
- .5 Provide cove and bullnose shapes where indicated and required to complete tile work.

2.4 MORTAR AND GROUT MATERIALS

- .1 Floor and Wall Tile Mortar System (excluding shower location): Provide the following materials:

- .1 Epoxy Bonding Mortar: 100% solids epoxy mortar system for installations where exceptional high-strength and chemical and impact resistance meeting ISO 13007 Type R2
- .2 Shower Wall Tile Mortar System (Waterproofing System)
 - .1 Waterproofing Membrane: Liquid applied waterproofing meeting ANSI A118.10.
 - .2 Epoxy Mortar: Provide mortar meeting ISO 13007 Type R2
- .3 Tile Grout Systems: Provide the following materials:
 - .1 Epoxy Grout: Water cleanable, chemical resistant, 100% epoxy additive and hardeners meeting ISO 13007 Type RG.

2.5 ACCESSORIES

- .1 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.
- .2 Divider strips:
 - .1 Laminated strips, core 32 x 3 mm black neoprene, outsides (both sides) brass 32 x 1.29 mm complete with anchors, both sides spaced at 150 mm on centre.
- .3 Sealant: in accordance with Section 07 92 00- Joint Sealants.
 - .1 Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .4 Ceramic Accessories: soap holder; semi-recessed, 150 x 150 mm face dimension combination soap holder and grab bar, colour shall match surrounding wall tile.

2.6 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.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 WORKMANSHIP

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2006/2007, "Ceramic Tile", except where specified otherwise.
- .2 Apply tile or backing coats 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 bull nosed.
- .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.

3.3 SITE 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.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11- Cleaning.

END OF SECTION

Part 1 - General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 23 37 13 - Diffusers, Registers and Grilles: Air inlets and outlets to be coordinated with ceiling work.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - .2 ASTM C635/C635M-17, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - .3 ASTM F1667-18 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 COORDINATION

- .1 Do not begin erection of ceiling suspension system until work above ceiling has been inspected by DCC Representative.

1.4 PRE-INSTALLATION MEETING

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with DCC Representative in accordance with Section 01 31 00 - Project Management & Coordination to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with work of other sections.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review accepted shop drawings for installation requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for C423acoustical suspension, acoustic panels and system accessories. Include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

- .1 Submit for review and acceptance of each component specified or necessary for complete installation. Include technical descriptive data.
- .2 Submit duplicate 150 mm x 100 mm samples of each type of acoustical unit.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Submit operation and maintenance data for acoustical suspension for incorporation into manual.
- .3 Submit final certificate from design professional responsible for delegated detail design of ceiling indicating conformity with accepted shop drawings.

1.7 MAINTENANCE MATERIALS

- .1 Provide extra acoustical units in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units amounting to 2 % of gross ceiling area for each pattern and type of acoustical panel or tile, suspension system and trim required for project, minimum 1 complete factory-sealed package of each.
- .3 Ensure extra materials are from same production run as installed materials.
- .4 Deliver extra materials for each type of acoustical unit in original unopened packages clearly identified, including colour and texture.
- .5 Deliver to DCC Representative, upon completion of the work of this section.

1.8 CERTIFICATIONS

- .1 Fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements. Include certification of sustainable requirements.

1.9 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 flat, indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect acoustical ceiling panels and suspension grid components from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Store extra materials required for maintenance, where directed by DCC Representative.

1.10 ENVIRONMENTAL REQUIREMENTS

- .1 Permit wet work to dry before beginning to install.
- .2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20 % before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Design Requirements:
 - .1 Intermediate and Heavy-duty systems to ASTM C 635/ASTM C635M.
 - .2 Maximum deflection: 1/360th of span to ASTM C 635/ASTM C635M deflection test.
- .2 Seismic design requirements:
 - .1 Design acoustical ceiling installation to resist effects of earthquake motions under seismic design conditions specified in Contract Documents. Provide components as necessary to implement design.

2.2 ACOUSTICAL CEILING SUSPENSION

- .1 Acoustical Ceiling Suspension system: as follows:
 - .1 2 directional exposed tee bar grid.
- .2 Basic materials for suspension system: commercial quality cold rolled steel.
- .3 Exposed tee bar grid components: shop painted satin sheen white colour. Components die cut. Main tee with double web, rectangular bulb and 25mm rolled cap on exposed face.
- .4 Hanger wire: galvanized soft annealed steel wire, nominal 2.6 mm minimum diameter.
- .5 Hanger inserts: purpose made.
- .6 Carrying channels: 38 x 65mm galvanized steel.

- .7 Accessories: splices, clips, wire ties, retainers and wall moulding, to complement suspension system components, as recommended by system manufacturer.

2.3 ACOUSTICAL CEILING PANELS

- .1 Acoustic units for suspended ceiling system (ACT-1): to CAN/CGSB-92.1, ASTM E1264. Match existing tiles.

- .1 Flat lay-in tile
- .2 Class A.
- .3 Textures: fine.
- .4 Light Reflectance: LR1
- .5 Edge type: square.
- .6 Colour: White.
- .7 Size: 1220 mm x 610 mm x 15mm thick.

- .2 Acoustic units for suspended ceiling system (ACT-2): to CAN/CGSB-92.1, ASTM E1264. Match existing tiles.

- .1 Flat lay-in tile
- .2 Class A.
- .3 Textures: fine.
- .4 Light Reflectance: LR1
- .5 Edge type: square.
- .6 Colour: White.
- .7 Size: Nominal 610 mm x 610 mm x 15mm thick.

Part 3 Execution

3.2 EXAMINATION

- .1 Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for acoustical ceiling tile and track installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.3 INTERFACE WITH OTHER WORK

- .1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, and sprinkler heads, to be built into acoustical ceiling components.

3.4 SUSPENSION SYSTEM INSTALLATION

- .1 Comply with manufacturer's written installation instructions and recommendations, including product technical bulletins, product carton installation instructions, and data sheets.
- .2 Install suspension system in accordance with ASTM C636/C636M except where specified otherwise.
- .3 Lay out system according to reflected ceiling plan centre line of ceiling both ways, to provide balanced borders at room perimeter.
- .4 Finished ceiling system to be square with adjoining walls and level within 1:1000.
- .5 Secure hangers to overhead structure using attachment methods as acceptable to DCC Representative.
- .6 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
- .7 Ensure suspension system is coordinated with location of related components. Provide carrying channels as necessary to bridge at unavoidable interference between suspension system and other work above ceiling.
- .8 Install wall moulding to provide correct ceiling height.
- .9 Completed suspension system to support super-imposed loads, such as lighting fixtures, grilles, diffusers and speakers.
- .10 Support at diffusers & light fixtures with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .11 Interlock cross member to main runner to provide rigid assembly.
- .12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .13 Install access splines to provide 25 % ceiling access.
- .14 Expansion joints:
 - .1 Erect two main runners parallel, 25 mm apart, on building expansion joint line. Lay in strip of acoustic tile/board, 25% narrower than space between 2 'T' bars.
 - .2 Supply and install "Z" shaped metal trim pieces at each side of expansion joint. Design to accommodate plus or minus 25 mm movement and maintain visual closure. Finish metal components to match adjacent exposed metal trim. Provide backing plates behind butt joints.
- .15 Install perimeter trim at floating installations securely anchored to suspension system, in accurate alignment with adjacent assemblies. Install curved trim members in smooth curves to radius indicated.

3.5 ACOUSTICAL CEILING PANEL INSTALLATION

- .1 Install lay-in acoustical panels in ceiling suspension system in accordance with manufacturer's instructions and as indicated.
- .2 Install fibrous acoustical media and spacers over entire area above suspended metal panels.
- .3 In fire rated ceiling systems, secure lay-in panels with hold-down clips and protect over light fixtures, diffusers, air return grilles and other appurtenances according to Certification Organizations design requirements.

3.6 SITE QUALITY CONTROL

- .1 Arrange for periodic site visits by design professional responsible for delegated ceiling design work to review installed work for conformity to design.
- .2 Arrange for periodic site visits by manufacturer's representative to review installed work for conformity to manufacturer's installation instructions and recommendations.
- .3 Submit written site reports by designer to DCC Representative within 3 days of visit.

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 Touch up scratches, abrasions, voids and other defects in painted surfaces.

3.8 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM F1303-04(2014), Standard Specification for Sheet Vinyl Floor Covering with Backing.
- .2 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

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 resilient sheet flooring and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit duplicate 300 x 300 mm sample pieces of sheet material and 300 mm long base edge strips.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide shop drawings, product data and samples according to Section 01 33 00 - Submittal Procedures.
 - .2 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.
 - .3 Extra materials one piece and from same production run as installed materials.
 - .4 Identify each roll of sheet flooring and each container of adhesive.
 - .5 Deliver to DCC Representative, upon completion of the work of this section.
 - .6 Store where directed by DCC Representative.

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 indoors, in dry location, off ground 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.

1.6 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

Part 2 Products

2.1 MANUFACTURERS

- .1 Acceptable Material: Solid surfacing material of this section is based on listed manufacture(s), which has been selected to establish a standard of acceptance with respect to design, function, quality, performance, colour, pattern, final texture, finished appearance and finish. For substitution materials, submit completed form DCL242 along with technical literature to DCC Representative for review and acceptance.

2.2 MATERIALS

- .1 Sheet Vinyl without Backing: to ASTM F1913 and tested to CAN/ULC S102.2, and as follows:
 - .1 Usage: Commercial.
 - .2 Thickness: 2 mm.
 - .3 Texture: smooth.
 - .4 Acceptable Materials:
 - .1 Polyflor, Palettone PUR, Colour: Earthenware 8641
 - .2 Forbo: Marmoleum Real, Colour: Sparrow fresco 3252
 - .3 Altro: Maxis Unity, Colour: Arena UB2510
- .2 Integral Cove: Sheet floor Manufacturer's standard cove forming materials for a complete installation; including floor to wall transition, inside corner transition. Provide details of all transitions to DCC Representative prior to installation of materials of this Section.
- .3 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
 - .1 Vinyl floor adhesives:
 - .1 Adhesive: maximum VOC limit 60 g/L.
- .4 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for resilient sheet flooring installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 PREPARATION

- .1 Remove existing flooring (if applicable).
- .2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.
- .3 Prepare surfaces in accordance with manufacturer's instructions and recommendations.
- .4 Prepare substrates to be smooth, flat, level, permanently dry, clean and free of foreign materials such as grease, oil, solvents, curing and hardening compounds, sealers, asphalt, old adhesive residue, construction films and coatings, stains and dust.
- .5 Level substrates to maximum 3 mm in 3 m and fill cracks using portland-cement based leveling and patching compounds in accordance with manufacturers' instructions. Do not lay resilient flooring over gypsum-based compounds.
- .6 Prepare existing concrete surfaces in accordance with ASTM F710.
- .7 Prime concrete slab to resilient flooring manufacturer's printed instructions.

3.3 APPLICATION: FLOORING

- .1 Install sheet flooring to Manufacturer's Specifications and written instructions
- .2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .3 Lay flooring with seams parallel to building line to produce a minimum number of seams. Border widths minimum 1/3 width of full material.
- .4 Run sheets in direction of traffic. Double cut sheet joints, continuously seal and heat weld according to manufacturer's printed instructions.
- .5 Heat weld seams of vinyl sheet flooring in accordance with manufacturer's printed instructions.

- .6 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.
- .7 Cut flooring around fixed objects.
- .8 Install feature strips and floor markings where indicated. Fit joints tightly.
- .9 Install flooring in pan type floor access covers. Maintain floor pattern.
- .10 Continue flooring over areas which will be under built-in furniture.
- .11 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .12 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .13 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.4 APPLICATION: INTEGRAL COVE BASE

- .1 Install integral cove base in conformance with Manufacturer's written instructions.

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.
 - .1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.

3.6 PROTECTION

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 07 92 00 - Joint Sealing.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International).
 - .1 ASTM C307-18. Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
 - .2 ASTM C413-18. Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - .3 ASTM C579-18. Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - .4 ASTM D2047-17. Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - .5 ASTM D2240-15e1. Standard Test Method for Rubber Property - Durometer Hardness.

1.3 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00.
- .2 Submit Manufacturers technical literature to indicate special handling procedures, preparation criteria, installation instructions, finishing and cleaning procedures.
- .3 Submit Product Data Sheets for each component. Include performance characteristics, performance criteria and limitations.
- .4 Submit Manufacturers WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health and Welfare Canada.
- .5 Submit shop drawings. Indicate layout of divider strips and expansion joints.
- .6 Submit samples. Submit duplicate 300 x 300 x 6 mm thick samples of each colour, texture and finish.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.
- .2 Provide manufacturer's standard maintenance instructions.

1.5 MOCK-UPS

- .1 Construct mock-ups in accordance with Section 01 33 00.
- .2 Prepare mock-up of a minimum area of 10 m2 or one complete room as directed by DCC Representative. Clean, prepare floor surfaces and apply floor coatings. DCC Representative to accept cleaning procedures, preparation of floor surfaces, application procedures and appearance of completed installation.

- .3 Construct mock-up where directed.
- .4 Allow minimum of twenty-four (24) hours for inspection of mock-up by DCC Representative before proceeding with coating work.
- .5 When accepted, mock-up will demonstrate minimum standard for this work. Accepted Mock-up may remain as part of the finished work.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store materials in accordance with Section 01 61 00. Deliver in original containers, sealed, with labels intact in manner to prevent damage.
- .2 Remove damaged, opened and rejected materials from site.
- .3 Ensure materials remain in original wrapping and containers until used.
- .4 Close and seal tightly all partly used containers. Store protected in well ventilated fire-safe area at moderate temperature.
- .5 Deliver materials to job site just prior to installation. Store materials inside, in dry location, away from heavy traffic areas.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Waste Management Plan.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
- .3 Divert unused aggregate materials from landfill to facility approved by DCC Representative. Divert unused epoxy matrix materials from landfill to official hazardous material collections site approved by DCC Representative.
- .4 Do not dispose of unused paint and epoxy materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Safety.
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of materials.
 - .2 Ensure no open flame heating devices are used.
 - .3 Discourage occupancy of treated space until volatile materials are no longer being emitted and there is no odour.
 - .4 Provide adequate respiratory protection to exposed individuals.
- .2 Ventilation.
 - .1 Provide ventilation continuously during and after cleaning, preparation and coating application. Operate system twenty-four (24) hours per day during

- application. Provide continuous ventilation for seven (7) days after completion of application or until all odours are reduced to approval of DCC Representative.
- .2 Ventilate enclosed spaces to approval of DCC Representative.
 - .3 Temperature.
 - .1 Do not apply coating systems unless uniform minimum 10 degrees C air temperature at installation area for twenty-four (24) hours prior to and after application.
 - .2 Maintain minimum temperature 10 degrees C within area of installation until final acceptance of building.
 - .4 Apply finish coatings only when dust is no longer being generated by related construction operations. Schedule operations such that airborne particles will not affect the quality of the finished surface.
 - .5 Apply coatings only when surfaces are clean, dry, properly cured and adequately prepared in accordance with manufacturers written instructions and to approval of DCC Representative.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Low odour products: whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour.
- .2 Interior, high-performance, seamless, 3 component, epoxy based flooring system. Heavy-duty, decorative, textured system. Nominal installed thickness 6.0 mm. standard slip resistance (type ef1) and high slip resistance (type ef2), medium texture. Colour and pattern selected by DCC Representative from manufacturer's standard available range.
 - .1 Physical Characteristics:
 - .1 Compressive Strength: 68.948 MPA at 7 days to ASTM C579.
 - .2 Tensile Strength: 13.790 MPA to ASTM C307.
 - .3 Hardness: 85-90 to ASTM D2240 shore D Durometer.
 - .4 Co-efficient of Friction: Medium Texture 0.7 to ASTM D2047.
 - .5 Water absorption: less than 0.1% to ASTM C413.
 - .2 Components:
 - .1 Primer: penetrating, two component, moisture tolerant, 100% solids epoxy primer.
 - .2 Base: 3 component, trowelled epoxy based mortar. Trowel applied mortar base, consisting of epoxy resin, curing agent and finely graded silica aggregate.
 - .3 Undercoat: 3 component, free flowing epoxy formulation consisting of resin and curing agent.
 - .4 Aggregate. Brightly coloured, select graded quartz aggregates.

- .5 Sealer. UV resistant, chemical resistant, 2 - component, 100% solids epoxy based, clear sealer.
- .6 Waterproofing membrane primer: Manufacturer's proprietary primer specifically intended for use with waterproofing membrane system for application to new and cured concrete. 3 - component, epoxy based system intended to completely seal the substrate and prevent the possibility of pinholes forming in the overlayment.
- .7 Waterproofing membrane: by same manufacturer as flooring. Recommended for use with flooring system. 2 - component, liquid applied, urethane membrane for use on horizontal surfaces. Minimum applied thickness: 25 mils. 100 % solids. Seamless and monolithic. Tensile strength: 7584.2 KPA. Bond strength: greater than 2757.9 KPA. Elongation: 200%.
- .3 Sub-floor filler and leveler: 2 part, latex modified, portland cement mortar requiring no water to produce cementitious paste. As recommended by epoxy coating manufacturer for use with their product. Minimum compressive strength of 25 MPa.
- .4 Metal edge strips: aluminum extruded, smooth, mill finish, shoulder flush with top of adjacent floor finish.
- .5 Accessories: base caps, base divider strips, separator strips, purpose made and to match divider strips.
- .6 Sealing compound: as recommended by epoxy manufacturer.

Part 3 EXECUTION

3.1 GENERAL

- .1 Comply with manufacturers written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet. Manufacturer's recommendations will be considered as minimal instructions. Method of application to be as approved by DCC Representative.
- .2 Apply coatings only when surfaces are clean, dry, properly cured and adequately prepared in accordance with manufacturers written instructions and to approval of DCC Representative.

3.2 WORKMANSHIP

- .1 Moisture content of concrete: maximum 16%.
- .2 Apply coating using trained applicators, using equipment specifically designed for this purpose.

3.3 PREPARATION

- .1 Remove surface mounted fittings and fastenings prior to undertaking any operations. Store for re-installation after operations are complete. Leave surfaces to be treated as free as possible from surface obstacles.

- .2 Test floors to ensure they are dry and cured to approval of manufacturer. Ensure that floor slabs are dry by using test methods as recommended by flooring manufacturer.

3.4 PROTECTION

- .1 Protect existing building surfaces as well as all mechanical and electrical equipment in areas of work from spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by DCC Representative.
- .2 Protect floors and adjacent spaces from damage caused by cleaning and preparation operations.
- .3 Mask around surrounding surfaces to produce neat, clean clear junction lines. Cover or mask surfaces, equipment and other hardware in areas of work to prevent damage and to protect from drops and splatters. Use non-staining coverings.
- .4 Protect items that are permanently attached. Protect factory finished products and equipment.

3.5 SURFACE PREPARATION

- .1 Prepare all floor surfaces in accordance with manufacturers written instructions and as follows:
 - .1 Remove ridges, bumps and other materials. Remove loose material, grind out protrusions.
 - .2 Completely remove, down to bare concrete: all coatings, laitance, paints, oils, grease, dirt, stains and any unsound concrete from concrete floors using a combination of commercial degreasers, alkaline wash, water blasting, hand grinding, shot blasting or wet sand blasting as required to suit site conditions.
 - .3 Thoroughly scrub concrete slab with heavy-duty detergent or cleaners appropriate to emulsify particular contamination present.
 - .4 Thoroughly rinse with clean water. Repeat procedure as required to remove contamination. Remove rinse water by forcing to appropriate drains or by power vacuum. Perform all chemical cleaning in strict accordance with federal, provincial and municipal regulations, which prohibit introduction of certain chemicals and contaminants into sewers, open bodies of water and into ground.
 - .5 Remove all remaining residue, dust, dirt, and other debris by vacuuming, wiping with dry, clean cloths.
 - .6 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .7 Allow surface to dry completely prior to application of any primers or surface coatings.
- .2 Do not proceed with application of new coatings until prepared surfaces have been accepted by DCC Representative.
- .3 Clean floor and apply filler. Patch depressions and fill cracks and holes. Trowel and float to leave smooth, flat hard surface. Apply filler to produce smooth and level surfaces, free from holes and bumps that would affect the appearance of the finished floors. Apply filler to achieve floor level to a tolerance of 1:500. Prohibit traffic until filler cured and dry.

Apply filler to create slopes as indicated, slopes to be minimum 1% to new drains unless noted otherwise. Feather edge filler at drains and at junction with existing surfaces.

3.6 INSTALLATION

- .1 Apply waterproofing membrane primer. Apply waterproofing membrane throughout entire area scheduled to receive epoxy floorings.
- .2 Apply primer, base and undercoat to all areas. Total system thickness 6.0 mm.
- .3 Broadcast aggregate evenly into wet surface of undercoat. Apply in both directions to ensure even coverage without any visible seams. Obtain uniform colour distribution to approval of DCC Representative.
- .4 Apply sealer at thickness to obtain medium texture and slip resistance as specified.
- .5 Apply flooring to produce smooth, level surface, uniform in thickness, sheen, colour, texture and finish, free from marks, dirt, particles, runs, crawls, curling, holes, air pockets and other defects.
- .6 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
- .7 Install divider strips straight and level to detailed pattern. Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.7 CLEANING

- .1 Remove excess materials from floor, base and wall surfaces without damage. Clean and seal floor and base surface to flooring manufacturer's printed instructions.

3.8 PROTECTION IN FINISHED WORK

- .1 Protect new floors from time of initial set until final inspection.
- .2 Prohibit traffic on floor for forty-eight (48) hours after installation or longer in accordance with manufacturer's written instructions.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY OF WORK

- .1 Work Included: The work of this Section includes the provision of all labour, materials, equipment and services required to execute interior and exterior painting work, as indicated on the drawings, as specified herein and as required for a complete project.
- .2 Related Sections:
 - 1. Section 01 33 00 - Submittal Procedures.
 - 2. Section 08 11 00 - Metal Doors and Frames
 - 3. Section 09 21 16 - Gypsum Board Assemblies.
 - 4. For mechanical and electrical items, refer Divisions 21 to 28.

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Master Painters Institute (MPI):
 - .1 MPI Architectural Specification Manual, 2004 (referred to herein as "MPI Manual")
 - .2 MPI Approved Product List (Referred to herein as "MPI APL").

1.4 SUBMITTALS

- .1 General: Submit each item in this Article according to the Conditions of the Contract and the applicable Division 01 Specification Sections.
- .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 2 copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) Indicate VOCs during application and curing.
 - .4 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .5 Submit manufacturer's application instructions.
 - .6 Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen

1.5 QUALITY ASSURANCE

- .1 Paint exposed surfaces. If a colour of finish, or a surface is not specifically mentioned, DCC Representative will select from standard products, colours and sheens available.

1.6 STANDARD OF ACCEPTANCE

- .1 Walls: not defects visible from a distance of 3'-0" at 90° to surface
- .2 Ceiling and bulkheads, no defects visible from floor at 45° to surface when viewed using final lighting source
- .3 Final coat to exhibit uniformity of sheen across full surface area.

1.7 STORAGE AND HANDLING

- .1 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 within temperature as recommended by manufacturer.
- .2 Fire Safety Requirements:
 - .1 Provide one 9 kg dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.8 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
 - .2 Test concrete, masonry and plaster surfaces for alkalinity as required.
 - .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.
- .3 Airborne Dust: 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.

1.9 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.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Only paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for each paint system from a single manufacturer.
- .3 Conform to latest MPI requirements for all painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Manual and APL.
- .5 Provide paint products meeting MPI "Environmentally Friendly" E2 rating or better, based on VOC (EPA Method 24) content levels. Where the APL lists products with E3 rating, select products from among those which have the E3 rating.
- .6 Paint shall not contain cadmium or lead.

2.2 PAINTS AND COATING

- .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written instructions. Obtain written approval from the DCC Representative for tinting of painting materials.
- .2 Use and add thinner in accordance with paint manufacturer's recommendations. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- .3 Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- .4 Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

2.3 INTERIOR PAINT SYSTEMS

- .2 Metal - Structural steel columns, joists, trusses, miscellaneous metal, ferrous metal)
 - .1 Latex system: INT 5.1Q, Egg-Shell / Satin Finish
 - .1 1st Coat: MPI#76
 - .2 2nd Coat: MPI#52/MPI#43
 - .2 3rd Coat: MPI#52/MPI#43
 - .3 Galvanized Metal - Metal Doors and Frames
 - .1 W.B. Light Industrial Coating: INT 5.3K, Semi-Gloss
 - .1 1st Coat: MPI#134
 - .2 2nd Coat: MPI#153
 - .3 3rd Coat: MPI#153
 - .4 Gypsum Board
 - .1 Ceiling: Latex – INT 9.2A, Flat
 - .1 1st Coat: MPI#50

- .2 2nd Coat: MPI#53
- .3 3rd Coat: MPI#53
- .1 Walls: Latex – INT 9.2A, Eggshell/Satin
 - .1 1st Coat: MPI#50
 - .2 2nd Coat: MPI#52/ MPI#43
 - .3 3rd Coat: MPI#52/ MPI#43
- .1 Walls: Latex – INT 9.2A, Semi-Gloss
 - .1 1st Coat: MPI#50
 - .2 2nd Coat: MPI#54
 - .3 3rd Coat: MPI#54
- .5 Concrete Masonry Units (CMU)
 - .1 WB Light Industrial Coating: INT 4.2K, Semi-Gloss
 - .1 1st Coat: Block Filler: MPI#4
 - .2 2nd Coat: MPI#153
 - .3 3rd Coat: MPI#153

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to the Construction Manager 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.

3.2 GENERAL – SURFACE 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 the DCC Representative.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.
- .2 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.
- .3 General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion
- .1 Remove items including but not limited to thermostats, electrical outlets, switch covers and

similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved

- .4 Aluminium: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
- .5 Drywall - Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.
- .6 Wood: Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth

3.3 APPLICATION

- .1 Method of application to be as approved by the Construction Manager. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .3 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by the manufacturer.
- .4 Sand and dust between coats to remove visible defects.
- .5 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.
- .6 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .7 Finish closets and alcoves as specified for adjoining rooms.
- .8 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surface.

3.4 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
- .2 Do not paint over nameplates.
- .3 Keep sprinkler heads free of paint.
- .4 Paint fire protection piping red.
- .5 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .6 Paint natural gas piping yellow.
- .7 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.

3.5 CLEAN UP

- .1 Clean, repair or replace and repaint damage work as directed by the DCC Representative.
- .2 Remove temporary protective covers after completion of project.
- .3 Clean paint spattered surfaces

.4 Leave areas broom clean

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Green Seal (GS)
 - .1 GS-11-2021, Standard for Paints and Coatings.
 - .2 GS-36-2021, Adhesives for Commercial Use.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for signage and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit catalogue sheets and full-size templates.
 - .2 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, and mounting methods, schedule of signs.
 - .3 Submit full size templates for individually fabricated lettering indicating word and letter spacing.
- .4 Samples:
 - .1 Submit duplicate representative sample of sign, sign image and mounting method including, but not limited to: graphics, cast letters, sign box installation method, channel letters, and wall plates fixed mounting installation method.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for signs for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .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, indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Acrylic sheet: polymethylmethacrylate (PMMA) cast sheet suitable for intended use in sign fabrication, colours to be selected by DCC Representative from standard manufacturer's colour range.
- .2 Self-stick foam tape: 3.2 mm thick, 352.4 kg/m³ density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides.
 - .1 Width: to suit sign sizes.
- .3 Adhesives, paints, sealants and solvents for acrylic sheet: type recommended by sheet manufacturer for applicable condition.
 - .1 Maximum VOC limit 30 g/L to GS-36 Standard.
- .4 Acrylic top-coat: clear, non-yellowing, exterior grade, satin finish, acrylic polyester resin protective coating, compatible with acrylic surface of type recommended by sheet manufacturer.
 - .1 Maximum VOC limit 50 g/L GS-11 Standard.
- .5 Bituminous paint: to MPI EXT 5.4D.
 - .1 Maximum VOC limit 50 g/L to GS-11 Standard.

2.2 SIGN GRAPHICS

- .1 Self-stick vinyl film: symbols die cut from 0.1 mm thick white integral colour, matte finish, exterior grade PVC film, with self-stick adhesive backing.
- .2 Language: bilingual English and French and international symbol.

2.3 SIGNS

- .1 Submit proof for each sign prior to fabrication.
- .2 Pictogram Sign (Interior):
 - .1 Two-ply, 1.3mm thick plastic plates laminated with laser etched universal washroom symbols. Plastic plates are to be permanently (tamperproof) secured to door without the use of screws. Sign edges: beveled. Corners: rounded.
 - .2 Sign Size: 150mm x 150mm.
 - .3 Sign Colour: to be selected by DCC Representative.
 - .4 Figure Colour: to be selected by DCC Representative.
 - .5 Sign graphics: apply by self-stick vinyl film letters.
 - .6 Location: centred on door at height as indicated in this section.

2.4 FABRICATION

- .1 Fabricate signs in accordance with details, specifications and shop drawings.
- .2 Build units square, true, accurate to size, free from visual or performance defects.
- .3 Exposed of same finish and colour as base material as permitted and where approved by DCC Representative.
- .4 Manufacturer's nameplates on sign surface are not permitted.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for signage installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Manufacturer's Instructions: compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Erect and secure signs plumb and level at elevations 1500mm above finish floor of centreline of sign with the final location directed by DCC Representative.
- .3 Comply with sign manufacturer's installation instructions and approved shop drawings.
- .4 Mechanical attachment:
 - .1 To concrete or solid masonry: use lag screws and expansion bolts or screws and fibre plugs, as appropriate for stresses involved.
 - .2 To hollow masonry: use toggle bolts or equivalent.
 - .3 Fabricate special fasteners as required for installation conditions.
 - .4 Mechanical fasteners and methods of attachment subject to DCC Representative's approval.
- .5 Adhesive attachment:
 - .1 Use self-stick adhesive foam tape to manufacturer's instructions to fix sign and prevent "rocking".
 - .2 Keep tape maximum 1.6 mm from edges.

3.3 CLEANING

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

- .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.
 - .1 Leave signs clean.
 - .2 Remove debris from interior of sign boxes.
 - .3 Touch up damaged finishes.
- .3 Waste Management: separate waste materials for recycling in accordance with Division 01.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SAMPLES

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

Part 2 Products





2.1 MATERIALS

- .1 Numbers: 2 mil self-stick vinyl reflective graphic film, white numbers.
.1 19mm high, Hyway Gothic Font.
- .2 Background: 6 mil self-stick vinyl reflective graphic film, green background to match Base standard.
.1 30 mm x 140 mm long.
- .3 Acceptable materials: 3M Scotchlite, Oracal, Catalina

Part 3 Execution

3.1 FABRICATION

- .1 Each sticker shall consist of a four digit number beginning with the letter “B” for basements (ex. B001) and a three digit number for other floors (ex. 101, 201) except as otherwise noted below.
- .2 Interior rooms within a room shall be identified with a letter following the main room number (ex. 101A). Secondary room within an interior room shall be identified with a number following the letter (ex. 101A1).
- .3 911 numbers shall be offset to the left side of background to allow for a 50 mm long TIS bar code sticker (installed by others) on the right side.
- .4 Numbering sequence will be supplied by DCC Representative.
- .5 Following are examples of 911 stickers:

	BASEMENT ROOM
	FIRST FLOOR ROOM
	INTERIOR ROOM WITHIN A ROOM
	ROOM WITHIN AN INTERIOR ROOM

3.2 INSTALLATION

- .1 Adhere signs plumb and level.

- .2 Adhere signs to head of door frame, on latch side of door.
- .3 Where no door frames exist, adhere to wall at side of opening, approx. 2130mm above floor.

3.3 MOUNTING LOCATION

- .1 Numbers shall be mounted on the outside of all interior doorways leading into 911 numbered rooms.
- .2 Hallways, stairwells, and closets do not require 911 numbers. Doorways leading into these rooms shall not be numbered.
- .3 Numbers are not required on exterior doorways.
- .4 All existing door/room numbers shall be removed so the rooms are identified by the new 911 number only.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 06 08 99 - Rough Carpentry for Minor Works
- .4 Section 09 30 13 - Ceramic Tiling
- .5 Section 09 21 16 - Gypsum Board Assemblies
- .6 Section 10 28 00 - Toilet and Bath Accessories

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A240/A240M-04a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .2 ASTM A480/A480M-18, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.
- .2 CSA Group (CSA)
 - .1 CSA B651-23, Accessible Design for the Built Environment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal toilet compartments and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Installation Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .2 Indicate fabrication details, plans, elevations, hardware, and installation details.
- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Low-Emitting Materials:
 - .1 Submit listing of adhesives, sealants, paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

- .2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, laminate adhesives used in building, stating that they contain no urea-formaldehyde.

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.
- .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 metal toilet compartments from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43- Environmental Procedures.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 35 43- Environmental Procedures.

Part 2 Products

2.1 MATERIALS

- .1 Metal toilet and shower partitions
 - .1 Mounting: Floor anchored/Overhead braced
 - .2 Stile Standard Height: 8 feet 0 inches (244 cm.)
 - .3 Sheet steel: commercial quality to ASTM A480/480M.
 - .4 Minimum base steel thickness:
 - .1 Panels and doors: 0.8 mm.
 - .2 Pilasters: 1.0 mm.
 - .3 Reinforcement: 3.0 mm.
 - .5 Stainless steel sheet metal: to ASTM A240/A240M, Type 430
 - .6 Headrails: 25mm x 41mm, extruded anodized aluminum with double-ridge, anti-grip design.
 - .7 Pilaster shoe: 0.8 mm stainless steel, 75 mm high.
 - .8 Attachment: chrome plated tamperproof type screws and bolts.

2.2 COMPONENTS

- .1 Hinges:
 - .1 Heavy duty, nylon bushings.
 - .2 Material/finish: stainless steel casting.
 - .3 Swing: inward.
 - .4 Return movement: gravity.
 - .5 Adjustable to hold door open at any angle up to 90 degrees.
 - .6 Emergency access feature.
- .2 Latch set: built-in, combination latch, door-stop, keeper and bumper, stainless steel.
- .3 Wall and connecting brackets: stainless steel extrusion or casting.
- .4 Coat hook: combination hook and rubber door bumper, stainless steel
- .5 Door pull: barrier-free type suited for out swinging doors, stainless steel

2.3 FABRICATION

- .1 Doors, panels and screens: 25 mm thick, two steel sheets faces pressure bonded to honeycomb core, to sizes indicated.
- .2 Pilasters: 32 mm thick, constructed same as door, to sizes indicated.
- .3 Include formed and closed edges for doors, panels and pilasters.
 - .1 Miter and weld corners and grind smooth.
- .4 Include internal reinforcement at areas of attached hardware and fittings.
 - .1 Temporarily mark location of reinforcement for toilet accessories.
- .5 Include 0.8 mm thick type 430 stainless steel protective shields on urinal side of toilet partition panels next to urinals and on urinal screens.
 - .1 Make protective shields 1000 mm high with top of shield 1200 mm above finished floor.
 - .2 Make shields to full width of partition or screen panel.
 - .3 Fasten with stainless steel screws.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal toilet compartment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

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 PREPARATION

- .1 Ensure supplementary anchorage, if required, is in place.

3.4 ERECTION

- .1 Do work in accordance with CSA B651.
- .2 Partition erection.
 - .1 Install partitions secure, plumb and square.
 - .2 Leave 12 mm space between wall and panel or end pilaster.
 - .3 Anchor mounting brackets to masonry/concrete surfaces using screws and shields: blocking/backing must be provided to hollow walls using bolts and toggle type anchors, to steel supports with threaded rods nuts and washers.
 - .4 Attach panel and pilaster to brackets with self-drilling screws.
 - .5 Allow for adjustment of floor-braced pilasters variations with screw jack through steel saddles made integral with pilaster.
 - .1 Conceal ceiling and floor fixings with stainless steel shoes.
 - .6 Equip doors with hinges, latch set, and each stall with coat hook mounted on side wall, mounting heights as indicated on drawings.
 - .1 Adjust and align hardware for easy, proper function. Set door open position at full open.
 - .2 Install door bumper: door mounted, type rubber.
 - .7 Equip out swinging doors with door pulls on outside of door in accordance with CSA B651.
 - .8 Install hardware and grab bars as indicated on drawings.
- .3 Floor supported partition erection.
 - .1 Secure pilasters to floor with pilaster supports anchored with minimum 50 mm penetration in structural floor.
 - .2 Level, plumb and tighten installation with levelling device.
 - .3 Secure pilaster shoes in position.
 - .4 Set tops of doors level with tops of pilasters when doors are in closed position.
- .4 Screens erection:
 - .1 Anchor wall-hung screen panels to walls with 3 panel brackets and wing brackets.

3.5 ADJUSTING

- .1 Adjust doors and locks for optimum, smooth operating condition.

- .2 Lubricate hardware and other moving parts.

3.6 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 after installation to remove construction and accumulated environmental dirt.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
 - .1 Remove surplus materials, rubbish, tools and equipment barriers.
 - .2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
 - .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
 - .4 Clean and polish hardware and stainless components.

3.7 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry for Minor Works
- .2 Section 09 21 16 - Gypsum Board Assemblies
- .3 Section 10 21 13.13 - Metal Toilet Compartments

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM B456-17(2017), Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - .3 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A924/A924M-18, 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 Group (CSA)
 - .1 CAN/CSA-B651-04(R2010), Accessible Design for the Built Environment.
 - .2 CAN/CSA-G164-M18(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 the Province of Ontario.
 - .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, and 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 DCC Representative.

1.6 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 indoors, 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.

Part 2 Products

2.1 MATERIALS

- .1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A167, Type 430
- .3 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, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.
- .2 Back Support: Stainless steel tube with solid phenolic backrest.
 - .1 Frame: 32 mm diameter, 1.6 mm thick, 18-8, Type 304 stainless steel tubing. Ends welded to concealed mounting flange. Snap on flange covers. Satin finish.
 - .2 Backrest: 254 mm x 102 mm x 16 mm thick solid phenolic sheet. Colour: white.
 - .3 Projection: 203 mm from face of wall.
- .3 Coat hook: heavy-duty metal single robe hook, concealed mounting, chrome finish.

- .4 Hand soap dispenser: liquid push-in valve 152 mm spout, self-contained 1.5 L tank, stainless steel piston and valve assembly, tamper proof filler lock surface mounted, exposed metal components chrome plated.
- .5 Feminine napkin disposal bin: stainless steel, surface mounted unit, continuous hinged door, self-closing, embossed with universally accepted symbol, removable stainless steel receptacles fitted with spring clip for deodorizer block.
- .6 Grab bar: Type 304, 1.25 mm stainless steel tubing, 38 mm outer diameter x 1.2 mm wall thickness, satin finish, peened. Provide concealed mounting with snap flange 50 x 80 x 3mm thick stainless-steel plate equipped with screw holes for attachment to wall. Provide 85 mm diameter x 0.8 mm thick x 13 mm deep flange covers. Cover to snap over mounting flange to conceal mounting screws and fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar to comply with CSA B651 accessibility guidelines for structural strength. Grab bar material and anchorage to withstand downward pull of 2.2 kN. Provide straight bars to lengths as indicated in the drawings.
 - .1 Sizes: 600 mm, as indicated.
 - .2 Sizes: 1000 mm, as indicated.
- .7 Grab bar: Type 304, 1.25 mm stainless steel tubing, 38 mm outer diameter x 1.2 mm wall thickness, satin finish, peened. Provide concealed mounting with snap flange 50 x 80 x 3mm thick stainless-steel plate equipped with screw holes for attachment to wall. Provide 85 mm diameter x 0.8 mm thick x 13 mm deep flange covers. Cover to snap over mounting flange to conceal mounting screws and fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar to comply with CSA B651 accessibility guidelines for structural strength. Grab bar material and anchorage to withstand downward pull of 2.2 kN. Provide L-shaped bars to lengths as indicated in the drawings.
 - .1 Sizes: 890mm x 760mm, as indicated.
 - .2 Sizes: 1000mm x 750mm, as indicated
- .8 Folding Shower / Dressing Bench: Wall mounted, folding shower seat. Fabricate frame from 18-8, type 304, satin finish stainless steel that consists of 1.6 mm thick, 30 mm square tubing and 1.2 mm thick, 25 mm diameter seamless tubing. Fabricate seat from one piece of 8 mm thick, solidly fused plastic laminate with matte-finish melamine surfaces. Ivory colored face sheets, and black phenolic resin core. Provide seat with slots for water drainage. Secure seat to frame with stainless steel carriage bolts and acorn nuts. Equip shower seat with two 75 mm diameter mounting flanges constructed of type 304, 5 mm thick, satin finish stainless steel. Provide a guide bracket constructed of type 304, 1.6 mm thick satin finish stainless steel and a spring constructed of 17-7, type 301 stainless steel, 0.6 mm thick that is spot welded to a baseplate of type 304 heavy gauge stainless steel. Seat shall be able to lock in upright position when not in use. Shower seat shall comply with CSA B651 barrier free accessibility guidelines. Overall size: 450 mm wide x 400 out from face of wall in lowered position.
- .9 Shelf surface mounted, 200 deep, 700 wide, stainless steel.
- .10 Shower curtain: anti-bacterial fire resistive self-extinguishing vinyl laminated fabric shower curtain. Provide curtain hold-back hook and chain at each curtain. Shower curtain to be based on manufacturer's standard length of 1828mm.

- .1 Width of curtain to be provided as noted:
 - .1 Standard Shower Stall: 1370mm
 - .2 Accessible Shower Stall: 1828mm
- .11 Shower rods: stainless 25 mm wall thickness steel tubing of required length with satin chrome finished flanges, 12 shower curtain hooks and curtain hold-back hook and chain. Shower rod material and anchorage to withstand downward pull of 0.9 kN.
- .12 Towel holder: surface mounted touch-free paper towel dispenser.
 - .1 Cabinet: 18-8, type-304. 0.8 mm stainless steel. All welded construction. Exposed surfaces have satin finish. Equipped with a tumbler lock keyed like other washroom accessories.
 - .2 Size: 295 mm wide x 380 mm high x 225 mm deep.
 - .3 Door: 18-8, type-304. 0.8 mm stainless steel with satin finish. Secured to cabinet with a full-length stainless steel piano-hinge.
 - .4 Roll towel mechanism: durable, high impact resin. Accepts standard core rolls up to 205 mm wide, 205 mm diameter. Dispenses one 305 m length of towel per pull. Accommodates up to 90 mm diameter stub roll with automatic transfer to full roll.
- .13 Soap holder: surface mounted, 5 mm thick stainless steel dished tray, self-draining, flush screws.
- .1 Waste receptacle: Floor standing waste receptacle. Open top, no cover.
 - .1 Receptacle: fabricate from 18-8, type-304. 0.8 mm stainless steel with satin finish. Equipped with vinyl bumper strip and rubber feet.
 - .2 Capacity 79.5 litres. Size: 756 mm high x 378 x 378 wide at top.
- .2 Mirror: wall mounted unit, fixed, framed mirror 6 mm, stainless steel frame, size 457 mm x 914 mm.

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 galvanize 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 Chrome and nickel plating: to ASTM B456, satin finish.
- .2 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 DCC Representative.
- .3 Manufacturer's or brand names on face of units not acceptable.

Part 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 DCC Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from DCC Representative.

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.
 - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
 - .4 Toilet and shower compartments: use male to female through bolts.
- .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.

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.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.6 SCHEDULE

- .1 Locate accessories were indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 08 99 - Rough Carpentry for Minor Works
- .2 Section 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-44.40-01, Steel Clothing Locker.

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 metal lockers 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 the Province of Ontario.
 - .2 Indicate on drawings: type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, end/back panels, trim, filler panels, finishes, bases, numbering, hooks, shelves, tops and accessories.

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:
 - .1 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, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal lockers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Lockers: to CAN/CGSB-44.40, Type 1-Single full-height locker.
 - .1 Lockers at Corridor:
 - .1 Size: 18" deep x 12" wide x 72" high
 - .2 Assembly: bolted construction.

- .3 Top: Sloped.
- .4 Doors: no door.
- .5 Door handle: N/A.
- .6 Colour: To be selected from manufacturer's standard colours.
- .7 Lockers at Change Rooms:
 - .1 Size: 18" deep x 12" wide x 72" high
 - .2 Assembly: bolted construction.
 - .3 Top: Flat.
 - .4 Doors: single-wall frameless construction
 - .5 Door handle: to match existing.
 - .6 Colour: To be selected from manufacturer's standard colours.

2.2 ACCESSORIES

- .1 Options: to CAN/CGSB-44.40
 - .1 Steel kick plate
 - .2 Steel base
 - .3 2 coat hooks min.
 - .4 Steel end panels
 - .5 Steel trim including filler panels
 - .6 Painted steel top shelf
 - .7 Bottom adjustable perforated shelf to be made of galvanized 16 gauge steel
 - .8 Plastic tray shelf insert.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive metal lockers previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to metal locker installation.
- .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from DCC Representative.

3.2 INSTALLATION

- .1 Assemble and install lockers in accordance with manufacturer's written instructions.
- .2 Securely fasten lockers to grounds and nailing strips.
- .3 Install wall trim around recessed locker banks.
- .4 Install filler panels (false fronts) where indicated and where obstructions occur.
- .5 Install finished end panels to exposed ends of locker banks.
- .6 Install locker numbers.

3.3 ADJUSTING

- .1 Adjust metal lockers 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.
- .2 Final Cleaning in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: in accordance with Section 01 35 43 - Environmental Procedures.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications
- .2 Section 01 74 11 - Cleaning

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A490M-14a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints Metric.
- .2 CSA Group
 - .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-2018, Welded Steel Construction (Metal Arc Welding).

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal shelving 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 the Province of Ontario, Canada.
 - .2 Indicate shelving layouts, number of bays, number of shelves, shelf liners, number and size of drawers, system of bracing and anchoring devices.
- .4 Samples:
 - .1 Submit representative sample bay of specified shelving showing finish colour and including accessories.

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 in dry location, off ground, indoors 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.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Metal storage shelving to support uniform load of 681.82 kg. (1500lbs.)
- .2 Design shelving to accommodate vertical adjustment of shelves of 25 mm increments and to permit easy assembly, expansion, dismantling and re-use of shelving component parts.

2.2 MATERIALS

- .1 Galvanized steel sheet: commercial grade to ASTM A653/A653M with Z275 zinc coating.
- .2 Steel sections and plates: to CSA G40.20/G40.21, Type 400 W.
- .3 Steel bolts, nuts and washers: to ASTM A490M.
- .4 Welding materials: to CSA W59.

2.3 PREFABRICATED COMPONENTS

- .1 Free Standing Boot Shelving: As fabricated from manufacturers standard components as follows:
 - .1 Post: Cold formed welded T-Post, base steel thickness 1.42 mm, 25 mm adjustment with no interference
 - .2 Metal Shelf: Formed 0.91 mm sheet steel.
 - .3 Wire Mesh Deck: Formed 0.91 mm perforated sheet steel.
 - .4 Accessories: Manufacturer's standard steel foot plate, steel side cross brace, back cross brace, hook for shelf, bolts and nuts.
 - .5 Shelf liner: Manufacturer's standard plastic shelf liner.

2.4 FINISH

- .1 Shop Finish: Manufacturers standard finish system.
 - .1 Colour: Light Gray.
 - .2 Manufacturer to provide touch-up paint for minor damage and scratches of finish.

Part 3 Execution

3.1 ASSEMBLY

- .1 Assembly of shelving unit on site to manufacturer's written instruction and accepted shop drawings.

3.2 INSTALLATION

- .1 Install metal storage shelving in accordance with reviewed layout.
- .2 Brace, secure and anchor shelving units in place.
- .3 Make good finish damaged during shipment or installation.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 06 08 99 - Rough Carpentry for Minor Works
- .3 Section 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
 - .1 North American Architectural Woodwork Standards (NAAWS) 3.1, 2018.
- .2 ASTM International
 - .1 ASTM F1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA LD-3-2005, High-Pressure Decorative Laminates (HPDL).
- .5 Construction, finishing and installation of custom millwork components in accordance with NAAWS including the following:
 - .1 Custom wood casework constructed from wood veneered plywood, Veneer shop applied to plywood and solid hardwood lumber.
 - .2 Custom wood casework constructed from plastic laminate covered plywood.
 - .3 Countertops covered with plastic laminate.
 - .4 Countertops covered with solid surfacing.
 - .5 Installation of associated hardware, accessories and fittings.
 - .6 Factory finishing including custom stain colours.

1.3 PRE-INSTALLATION MEETING

- .1 Prior to enclosing framing, convene a meeting of contractor, casework fabricator, casework installer, framing subcontractor and DCC Representative.
 - .1 Review locations of backing required for casework installation as shown on shop drawings and as necessary for installation.
 - .2 Review method of attachment for backing to wall system.
 - .3 Review coordination with other affected sections.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Prepare and submit material list in accordance with AWMAC NAAWS, cross-referenced to specifications.

- .2 Include manufacturer's instructions, printed product literature, data sheets and catalogue pages for all materials and products to be incorporated into architectural wood casework and include product characteristics, performance criteria, dimensions and profiles, finish and limitations on use.
- .3 Submit WHMIS MSDS in accordance with Sections 01 35 43- Environmental Procedures.
- .3 Shop Drawings:
 - .1 Prepare and submit shop drawings in accordance with AWMAC NAAWS and as follows.
 - .2 Submit drawings for review in accordance with requirements of Division 01 33 00 – Submittal Procedures.
 - .3 Indicate details of construction, profiles, jointing, fastening and other related details; and as follows:
 - .1 Provide details for solid surface countertop including all associated support structure including Decorative Laminate (HPDL) covered bracket.
 - .4 Indicate materials, thicknesses, finishes and hardware.
 - .5 Indicate locations cut-outs in countertop, coordinate locations with sub top.
 - .6 Indicate AWMAC NAAWS quality grade where different from predominant grade specified.
 - .7 Include finishes of all surfaces, exposed, and semi-exposed locations.
- .4 Samples:
 - .1 Prepare and submit samples in accordance with AWMAC NAAWS and as follows.
 - .2 Submit two (2) samples of solid surface for each specified colour selection.
 - .3 Submit two (2) samples of HPDL laminate for each specified colour selection.

1.5 QUALITY ASSURANCE

- .1 Perform Work of this Section by single architectural wood casework fabricator.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver wood casework only when area of work is enclosed, plaster and concrete work is dry, and area is broom clean and site environmental conditions are acceptable for installation.
- .3 Protect millwork against dampness and damage during and after delivery.
- .4 Store millwork in ventilated areas, protected from extreme changes of temperature and humidity, and within range recommended by AWMAC NAAWS for location of project.
- .5 Store materials indoors in clean, dry, well-ventilated area.
- .6 Protect architectural woodwork and hardware from nicks, scratches, and blemishes.
- .7 Replace defective or damaged materials with new.

- .8 Waste Management: for packaging and materials, in accordance with Sections 01 35 45 - Environmental Protection.

1.7 WARRANTY

Provide a written guarantee, stating that the work of this Section shall remain free of defects in materials and workmanship for a period of five years after substantial performance of the Work. Warrant that work will be structurally sound and free from distortion and deformation, that the complete assembly will be free from deterioration and that all hardware shall remain free of defects and functional during the warranty period.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Provide all materials and perform all fabrication in accordance with AWMAC NAAWS Custom Grade.

2.2 MANUFACTURERS

- .1 Acceptable Material: Solid surfacing material of this section is based on listed manufactures, which has been selected to establish a standard of acceptance with respect to design, function, quality, colour, pattern, final texture, finished appearance and finish. For substitution materials, submit full and complete technical literature to DCC Representative for review and acceptance

2.3 MATERIALS

- .1 Lumber
- .1 Dimensional Lumber: Refer to Section 06 08 99 – Rough Carpentry for Minor Works.
- .2 Subtop and Facia Sub-Board: Plywood as indicated in Section 06 08 99 – Rough Carpentry for Minor Works
- .3 High Pressure Decorative Laminate (HPDL): Meeting CAN/CSA A172 or ANSI/NEMA LD3 composed of phenolic resin impregnated kraft paper filled stock for class 1 Decorative Laminate of grade required by woodwork quality standard; general purpose grade, HGS standard duty;
- .1 Finish/ Colour: White.
- .4 Solid Surface Countertop: Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
- .1 Finish: Matte (gloss range 5-20
- .2 Thickness: Nominal 13 mm
- .3 Acceptable Material:
- .1 DuPont Corian: Terra Collection, Cocoa Brown
- .2 Formica Classics: Luna Weather 782

.3 Avonite Foundations: Dark Roast F1-7735

2.4 FABRICATION

- .1 Fabricate countertops components Manufacturer's written instructions, AWMAC NAAWS and accepted shop Drawings:
 - .1 Grade: Custom.
- .2 Countertop Fabrication Configuration:
 - .1 Fabricate tops with shop-applied facia, waterfall profile to dimension indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - .2 Sink: Surface mounted per Division 22, shop cut sink openings
 - .3 Fabricate with loose backsplashes for site assembly.
 - .4 Sidesplash: Match backsplash.
 - .5 Joints: Fabricate countertops without joints; if joints are required located as indicated in accepted Shop Drawings.
- .3 Countertop Support Bracket: All surfaces to be finished.
 - .1 Bracket Profile: As indicated.
 - .2 Core: Plywood
 - .3 Exposed surfaces: HPDL
 - .4 Exposed Edges: Match exposed surface.

2.5 ACCESSORIES

- .1 Joint adhesive: Manufacturer's standard one or two-part adhesive to create inconspicuous, nonporous joints.
- .2 Sealant: Manufacturer's standard mildew-resistant silicone sealant in colors matching components.
- .3 Plumbing Fixtures: Lavatory Sink(s) as indicated in Division 22.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and blocking are acceptable for countertop installation in accordance with manufacturer's instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied DCC Representative.

3.2 INSTALLATION

- .1 Install architectural wood casework in accordance with AWMAC NAAWS grade for respective items.
- .2 In case of conflict between Contract Documents and AWMAC NAAWS grade requirements, Contract Documents govern.
- .3 All work shall be secured in place, square, plumb, and level.
- .4 All work abutting other building components shall be properly scribed.
- .5 Install shop fabricated wood brackets in locations indicated on accepted Shop Drawings.
- .6 Countertop Frame: Site fabricate in-place to dimensions indicated on Shop Drawings, fasten to wall blocking and supporting wall brackets.
- .7 Sub-top and fascia, site fabricated in-place with water-resistant (exterior grade) plywood; fasten to framing members as indicated. Fasten sub tops to wood framing by screwing through sub tops into framing. Shim as needed to align sub tops in a level plane.
- .8 Secure countertops to sub tops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- .9 Install countertops level to a tolerance of 3 mm in 2.4 m, 6 mm maximum. Do not exceed 0.4 mm difference between planes of adjacent units.
- .10 Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- .11 Apply sealant to gaps at walls; comply with Section 07 92 00 - Joint Sealants.

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.
 - .1 Clean outside surfaces and inside cupboards and drawers.
 - .2 Remove excess glue, pencil and ink marks from surfaces.
- .3 Waste Management: separate waste materials in accordance with Section 01 35 45 - Environmental Protection.

3.4 PROTECTION

- .1 Protect countertop from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by countertop installation.

END OF SECTION

Part 1. General

1.1. RELATED SECTIONS

1. Division 21 - Sprinkler System.
2. Division 26 - Electrical.

1.2. SYSTEM DESCRIPTION

1. Design, fabrication and installation of multiple interior, self-contained factory fabricated packaged Air Shower enclosures.
2. Design system to removing surface particles from personnel leaving a contaminated area and incorporate a high velocity, low air pressure system.
3. Provide for connection to building electrical system. Design equipment to accommodate existing building electrical system.

1.3. REFERENCES

1. American Society for Testing and Materials International, (ASTM).
2. ASTM A167-99(2009). Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
3. ASTM B221-13. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.4. DESIGN REQUIREMENTS

1. Design the enclosures to meet the requirements of governing codes and jurisdiction and to comply with safety criteria for the intended use.
2. Design systems to incorporate Emergency Power Off (EPO) buttons inside the system as well as adjacent to both doors at the exterior of the assembly.
3. Provide for controlled access to the air shower enclosure. Design doors to operate as an air lock where both doors are electronically interlocked and cannot be opened at the same time. Design the controls so that when one door opens, the system energizes the magnetic lock on the opposite door, preventing it from opening. Design the control and operating system to ensure that during the cleaning cycle, both doors are locked to prevent anyone entering or leaving the chamber before the cycle is completed.
4. Noise and Vibration:
 1. Maximum exterior noise level: 74dba with a back ground noise level of 10 dba.
 2. Maximum interior noise level: 87 dba.
 3. Isolate the fan / blower assembly from the enclosure with rubber isolator pads.

1.5. SUBMITTALS

1. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
2. Provide product data sheets for all standard components.
3. Submit Shop Drawings:

4. Indicate complete layout and configuration of each enclosure Include layout and details of all components and accessories.
 1. Indicate design and fabrication details indicate hardware and installation details.
 2. Indicate component profiles, sizes, connection attachments, reinforcing, size and type of fasteners, and accessories.
 3. Include installation drawings, elevations, and details.
 4. Submit design data. Submit Test Reports and substantiating engineering data and test results of previous tests by independent laboratory, which purport to meet performance criteria, and other supportive data. Submit certificate signed by Manufacturer that products meet all specified requirements.
5. Provide maintenance data for incorporation into maintenance manual.

1.6. QUALITY ASSURANCE

1. Manufacturer Qualifications: manufacturer specializing in the design, fabrication and installation of air shower enclosures and related equipment.
2. Installer Qualifications: company specializing in performing work of this section and approved by Manufacturer.

1.7. DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
2. Deliver materials in manufacturer's original, unopened, undamaged packages with identification labels intact.
3. Store components protected from exposure to harmful conditions, at temperature and humidity conditions recommended by manufacturer.
4. Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.
5. Store components in temperature controlled environments. Leave protect film on components until time of installation.
6. Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2. Products

2.1. MATERIALS

1. Materials.
 1. Stainless Steel plate: to ASTM A167.
 2. Aluminum extrusions: to ASTM B221. Type 6061-T6 alloy.
 3. Bolts, nuts, and washers for stainless steel: stainless steel, matte finish.

2.2. COMPONENTS

1. Enclosure: prefabricated wall and roof sections with integral air duct plenums.
2. Wall and roof panels: factory fabricated from 16 gauge, type 304 stainless steel. Finish: number 4 brushed finish to all exposed surfaces. Design walls and roof panels to support a minimum of 200 pounds per square foot with a maximum deflection of 0.25 inches.
3. Provide access for maintenance of equipment and machinery from the exterior side of the enclosure. Locate all mechanical equipment on the exterior of the enclosure. Locate the mechanical equipment on the side walls and on the ceiling of the enclosure as indicated. Provide removable access panels enclosing the mechanical equipment.
4. Mechanical section: contains the blower/ motor unit, air nozzles, HEPA filters and electrical controls.
 1. Blower: locate the blower / motor unit in a self-contained blower box with hinged and gasketed access doors. Provide sound and vibration isolation between the blower box and the air shower enclosure.
 2. Blower: single paddle wheel, non-overloading fan/blower. Capacity: minimum 1010 cubic feet per minute at 4 inches static pressure. Velocity: 7000 Feet per minute at the face of the nozzle.
 3. Blower motor: direct drive high pressure. NEMA design B with class A insulation, designed to operate at 40 degrees C. 87.5% efficiency. Sealed ball bearings. Open drip proof. Speed: 3500 RPM. Provide motor starter with short circuit and overload protection.
 4. Air Nozzles: fabricate from heavy gauge PVC or anodized aluminum. Colour: manufacturer's standard. Adjustable. Output capacity: 7500 fpm each. Distributed equally across the surface of the wall panels with a minimum number located in the ceiling panels.
 5. Pressure gauges: provide pressure gauges installed on both sides of the HEPA filters as well as both sides of the pre-filters. Provide sensors at the nozzle outlet.
5. Electrical: provide main non-fused disconnect mounted in the power panel. Connect the power panel to the air shower with teck cable sized to Code. Mount the panel adjacent to the air shower clear of the air shower access panels.
 1. Existing building supply: 208V 3 phase, 60 Hz.
 2. Controls: designed to allow easy, on-site adjustment of system parameters. 120 V integrated PLC based control system to operate and control each enclosure. Ceiling mounted occupancy sensors. Automatic start. Programmable controller with DC inputs and relay outputs. Provide timers adjustable from 1 to 99 second run time and 0 - 10 second wait time.
 3. Cycle Control: design system to operate as follows: Program the system to operate the cleaning cycle on personnel as they EXIT from the spaces.
 1. The exit door will be locked when the entry door is open.
 2. The cleaning cycle will begin upon entry after entry door closes.
 3. All doors will be locked during the cleaning cycle.
 4. Cleaning cycle: high velocity blower will run for from 10 to 99 seconds (user adjustable).

5. Personnel shall exit through exit door. Entry door remains locked.
6. When the exit door closes, all doors unlock and the system resets.
7. When the exit door opens first, the air shower acts as an air lock and the blower does not run.
4. Controls: Color LCD touchscreen.
5. Occupancy sensor, door contacts: manufacturer's standard.
6. Alarms: provide for audible alarms both inside and outside the enclosure to indicate failure or emergency situations.
7. Provide preprogrammed scenario based on manufacturers factory setting. Diagnostics reporting feature.
8. Lighting: 24 VDC system powered by a step down transformer in the power panel. Fixtures: LED flush mounted ceiling strip light. Provide number of fixtures as required to provide a uniform 40 FC light level across the entire enclosure measured at 900 mm above the floor. Interconnect with occupancy sensor to allow lights to be automatically shut off when there are no personnel in the enclosure.
9. Provide for connection to building Fire Alarm system so that when an alarm is received the system engages the emergency override and occupants can exit the enclosure.
6. Filters: provide filter system consisting of pre-filters, filters, grilles, mounts and enclosures.
 1. Filter compartment: exterior mounted, accessible compartment with hinged and gasketed access doors. Fabricate from rigid aluminum plate.
 2. Pre-filters: locate pre-filters on the return air side on the lowest part of the wall. Disposable filters rated at MERV 7. Provide pre-filter in standard available sizes. Install hinged grille to allow easy access to pre-filters for service.
 3. Filters: HEPA rated. 99.99% efficient at 0.3 microns with aluminum or steel frames. Sized to maintain design air flow even when partially loaded with particulates. Provide for complete sealed and gasketed fitting between the filter and the filter housing. Provide HEPA filters in standard available sizes.
 4. Grilles: prefinished aluminum.
 5. Mounts: sufficient rigidity and bracing/clamping to ensure no filter or seal damage during normal shipping, handling rigging, and installation.
7. Doors: commercial heavy duty grade aluminum framed entrance doors and frames. Size: 36 inches wide x 80 inches high. Clear anodized finish. Glazing: minimum 6 mm thick clear tempered safety glass. Manufacturer's standard hardware package including: heavy duty ball bearing hinges, push/pull hardware, heavy duty hydraulic closers, locks, latches, thresholds, gaskets sweeps and weatherstripping. Provide electrical interlocks with control system and emergency stop buttons located at each exterior door and (1) within air shower. Provide 24 VDC magnetic door locks with 600 pounds holding force operated by control system. Door swing as indicated in the drawings.
8. Sprinkler: provide a sleeve for installation of sprinkler fittings inside the enclosures.

2.3. FABRICATION

1. Fabricate components in sizes to allow simplified shipping and to allow for installation in existing buildings.
2. Fabricate items with preformed joints to allow field installation with tightly fitted and secured connections between panels.
3. Fabricate panels so that exposed joints are flush and smooth with adjacent finish surface.
 1. Make exposed joints butt tight, flush, and hairline.
 2. Ease exposed edges to small uniform radius.
4. Exposed mechanical fastenings: screws or bolts; consistent with design of component.
5. Furnish and install components required for attachment of accessories.
6. Fabricate related components of same material and finish as enclosure, except where specifically noted otherwise.

Part 3. Execution

3.1. EXAMINATION

1. Examine surfaces and areas of work. Report to the DCC Representative in writing, defects of work prepared by other trades and other unsatisfactory site conditions, which would cause defective installation of products, or cause latent defects in workmanship and function.
2. Do not begin installation until openings and substrates have been properly prepared.
3. Verify exact location of air shower installations. Verify that rough openings and surfaces are ready to receive work. Verify dimensions, tolerances, and method of attachment with other work.
4. Commencement of work will imply acceptance of prepared work.

3.2. PREPARATION

1. Clean surfaces thoroughly prior to installation.
2. Prepare surfaces as recommended by the manufacturer to achieve the best result for the substrate under the project conditions.
3. Provide templates and rough-in measurements as required.

3.3. INSTALLATION

1. Install enclosures in accordance with approved shop drawings and manufacturer's recommendations.
2. Co-ordinate installation with work of related trades.
3. Install all work plumb, true, level, accurately and tightly fitted and flush with adjacent surfaces as required. Install work free from distortion or defects.
4. Install enclosures plumb and level. Seal the perimeter of both sides of the opening as required.
5. Upon completion, operate unit and make necessary adjustments.

6. Connect mechanical and electrical services as specified in Mechanical and Electrical divisions.
7. Obtain approval from DCC Representative prior to site cutting or making adjustments not scheduled.
8. Adjust and leave equipment in proper working order.

3.4. PROTECTION OF FINISHED WORK

1. Protect finished Work from damage until completion.
2. Touch-up, repair or replace damaged products.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Forces Fire Marshall
 - .1 Canadian Forces Fire Marshall Directive FMD 4003: Fire Protection Engineering, Fire Protection and Life Safety Engineering Design Guide, September 2019.
- .2 CFB Borden Site Specific Design Criteria, 2021-04-29.
- .3 Department of National Defence
 - .1 Department of National Defence Standard C-05-040-005/TS-001 Part 3, Section 2 Decontamination Procedures, Facilities and Zones
 - .2 Department of National Defence Standard C-05-040-005/TS-001 Part 4, Section 1 Refinishing Facility
 - .3 Department of National Defence Standard C-12-010-062/TP-000 Part 1, Section 3 Facilities, Tools and Equipment
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2021, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 25-2017, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
 - .3 NFPA 33-2021, Standard for Spray Application Using Flammable or Combustible Materials
- .5 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2020 (NBC).
 - .2 National Fire Code of Canada 2020 (NFC).
- .6 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-14-AMD1(Including Amendment 1), Standard for the Installation of Fire Alarm Systems.
- .7 Manufacturer's instructions
- .8 The latest version of codes, standards, and regulations referenced by the above codes and standards

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Provide detailed hydraulic calculations.
- .3 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .2 Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.
 - .6 Reinforcement.
 - .7 Assembly details.
 - .8 Accessories.
- .5 Samples:
 - .1 Submit samples of:
 - .1 Submit samples of each type of sprinkler head and each type of valve and alarm device sign.
- .6 Test Reports:
 - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from an approved independent testing laboratory, indicating compliance with specifications for specified performance characteristics and physical properties.
- .7 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .8 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.
- .9 Site Quality Control Submittals:
 - .1 Manufacturer's Site Reports: Submit manufacturer's site reports as specified.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00- Closeout Submittals in accordance with NFPA 13.
- .2 Manufacturer's catalogue Data, including specific model, type, and size for:
 - .1 Pipe and fittings.
 - .2 Alarm valves.
 - .3 Valves, including gate, check, and globe.
 - .4 Sprinkler heads.
 - .5 Pipe hangers and supports.
 - .6 Pressure or flow switch.
 - .7 Excess pressure pump.

- .8 Mechanical couplings.
- .3 Drawings:
 - .1 Sprinkler heads and piping system layout.
 - .1 Prepare 760 mm by 1050 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
 - .2 Show data essential for proper installation of each system.
 - .3 Show details, plan view, elevations, and sections of systems supply and piping.
 - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
 - .2 Electrical wiring diagrams.
- .4 Design Data:
 - .1 Calculations of sprinkler system design.
 - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
- .5 Field Test Reports:
 - .1 Preliminary tests on piping system.
- .6 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
 - .2 Submit 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.
- .7 Operation and Maintenance Manuals:
 - .1 Provide detailed hydraulic calculations including summary sheet, and Material and Test Certificate for piping and other documentation for incorporation into manual in accordance with NFPA 13.

1.4 QUALITY ASSURANCE

- .1 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.
 - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.6 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.
- .3 Storage and Protection:
 - .1 Store materials indoors and in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .4 Packaging Waste Management: remove for recycling in accordance with Section 01 35 43 Environmental Procedures.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for light hazard for washrooms at 4.1 mm/min, and for extra hazard group 2 for other areas at 16.3 mm/min over 232m².
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment.
- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .6 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for the protected hazard occupancies.
 - .2 Uniformly space sprinklers on branch.
- .7 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
 - .2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density.
- .8 Density of Application of Water:
 - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.

- .9 Sprinkler Discharge Area:
 - .1 Area: hydraulically most remote 232 m² (2500 ft²)
- .10 Outside Hose Allowances:
 - .1 Include allowance in hydraulic calculations of 1893 L/min (500 gpm)
- .11 Friction Losses:
 - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping and 140 for cement-lined ductile-iron piping.
- .12 Water Supply:
 - .1 Base preliminary hydraulic calculations on the below results of waterflow tests performed on Jun 22, 2014, provided by DCC Representative for bidding, and NFPA 13, with a minimum safety factor of 35 kPa (5 psi) at the system's design flow rate.
 - .1 Hydrant A-13
 - .1 Static pressure 448 kPa
 - .2 Flow of 3954.23 L/min at 224 kPa
 - .3 Flow of 4696.19 L/min at 140 kPa
 - .2 Hydrant A-14
 - .1 Static pressure 448 kPa
 - .2 Flow of 3954.23 L/min at 245 kPa
 - .3 Flow of 4952.58 L/min at 140 kPa
 - .2 The contractor must redo waterflow tests and base hydraulic calculations on new results after contract awarded.

2.2 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Conceal piping in areas with suspended ceiling.

2.3 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: to NFPA 13.
- .2 Fittings and joints to NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
 - .2 Provide threaded or grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.

- .3 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
- .4 Fittings: ULC approved for use in wet pipe sprinkler systems.
- .5 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
- .6 Side outlet tees using rubber gasketed fittings are not permitted.
- .7 Sprinkler pipe and fittings: metal.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Gate valves: open by counter clockwise rotation.
 - .3 Provide double check valve backflow preventer assembly for fire protection systems (DCVAF) integrated with butterfly valves with tamper switch, and test ports, test valves, drain valves, and other types of valves for the new system in accordance with code and standard requirements.
 - .4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.
 - .5 Provide an emergency normally closed butterfly control valve in piping supplying sidewall sprinkler at top of exhaust duct of spray booth
- .4 Pipe hangers:
 - .1 ULC listed for fire protection services in accordance with NFPA.

2.4 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type: match existing sprinkler heads in the same area.
 - .1 Type A: upright bronze.
 - .2 Type B: chrome polished pendent.
 - .3 Type C: side wall open type.
- .3 Provide sprinkler heads.
 - .1 Release element of each head to be of ordinary temperature rating or other ratings as suitable for specific application.
 - .2 Provide polished chromium-plated pendent sprinklers below suspended ceilings.
 - .3 Deflector: not more than 75 mm below suspended ceilings.
 - .4 Ceiling plates: not more than 25 mm deep.
 - .5 Ceiling cups: not permitted.

2.5 ALARM CHECK VALVE

- .1 Alarm check valve to NFPA 13 and ULC listed for fire service.
- .2 Provide variable pressure type alarm valve complete with drain valve, accessories, appurtenances, alarm test valve, pressure gages for proper operation of system.

- .3 Provide valve complete with internal components that are replaceable without removing the valve from the installed position.

2.6 SUPERVISORY SWITCHES

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Tamper switches for control valves:
 - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
 - .2 Explosion-proof if in the electrically classified areas.
- .3 Pressure alarm switch:
 - .1 With normally open and normally closed contacts and supervisory capability.
 - .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
 - .3 Connect into building fire alarm system.
 - .4 Connection of switch: coordinating with electrical trade.
 - .5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 90 seconds and instantly recycle.

2.7 EXCESS PRESSURE PUMP

- .1 Provide pumps on each sprinkler piping riser.
- .2 Pumps:
 - .1 Pumps: positive displacement, gear type rated at 1 lpm, integrally mounted with motor.
 - .2 Double acting displacement type, open cylinder design, direct drive, ULC listed, complete with relief valve.
- .3 Pump and motor unit:
 - .1 Approved for automatic wet pipe fire extinguishing sprinkler systems; complete with pilot light panel, differential motor control switch, high pressure switch, and low pressure switch.
 - .2 EEMAC Class B squirrel cage induction 1725 rpm, continuous duty, drip proof, ball bearing, maximum temperature rise 50 degrees C, 0.25 kW, 120/1/60.
 - .3 Capacity: 7.6 L/min.
- .4 Provide electrical power supply connections for pump and pilot light panel at supply side of building service panel.
- .5 Provide separate fused safety-type switch with locked lever for each connection.
- .6 Provide pressure pump sensing piping in supply piping upstream of fire pump.
- .7 Pump operation switch: to operate excess pressure pump with pressure differential of 103 kPa.
- .8 Shut-off valve and strainer on pump inlet. Relief valve, check valve and shut-off valve on discharge connections.

2.8 PRESSURE GAUGES

- .1 ULC listed and to NFPA 13.
- .2 Maximum limit of not less than twice normal working pressure at point where installed.

2.9 PIPE SLEEVES

- .1 Provide pipe sleeves where piping passes through walls, floors, roofs.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of floors, roofs, walls.
- .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
 - .1 Firmly pack space with mineral wool insulation.
 - .2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass.
 - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material, providing fire rating in accordance with code and standard requirements.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide cast-iron sleeves.
 - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
- .6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide 0.61 mm thick galvanized steel sheet.

2.10 ESCUTCHEON PLATES

- .1 Provide metal plates for piping passing through walls, ceilings, floors in exposed spaces.
- .2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

2.11 INSPECTOR'S TEST CONNECTION

- .1 Provide test connections at an accessible point and approximately not over 2.1 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
- .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.12 SIGNS

- .1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA 13.

- .2 Permanently fix hydraulic design data nameplates to riser of each system.

2.13 SPARE PARTS CABINET

- .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.
- .2 Testing to be witnessed by Canadian Forces Fire Marshal.

3.3 PIPE INSTALLATION

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.

3.4 ELECTRICAL CONNECTIONS

- .1 Provide electrical work associated with this section under Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide fire alarm system under Section 28 31 00 – Multiplex Fire Alarm System.
- .3 Provide control and wiring, including connections to fire alarm systems, in accordance with ULC524.
- .4 Provide wiring in rigid metal conduit or intermediate metal conduit.

3.5 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

- .1 Notify DCC Representative in writing at least 15 days prior to connection date.
- .2 Furnish materials required to make connections into existing water supply systems, and perform other incidental labour as required.

3.6 FIELD PAINTING

- .1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 mil, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 mil.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:
 - .1 Piping in Finished Areas:
 - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
 - .2 Provide piping with self-adhering red plastic bands 50 mm wide red enamel bands spaced at maximum of 6 m intervals.
 - .2 Piping in Unfinished Areas:
 - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in spaces above suspended ceilings, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
 - .2 Provide piping with self-adhering red plastic bands 50 mm wide red enamel bands spaced at maximum of 6 m intervals.

3.7 FIELD QUALITY CONTROL

- .1 Site Test, Inspection:
 - .1 Perform test to determine compliance with specified requirements in presence of DCC Representative.
 - .2 Test, inspect, and approve piping before covering or concealing.
 - .3 Preliminary Tests:
 - .1 Forward flow test.
 - .2 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
 - .3 Flush piping with potable water in accordance with NFPA 13.
 - .4 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
 - .5 Test alarms and other devices.
 - .6 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

- .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
 - .2 Submit written request for formal inspection at least 15 days prior to inspection date.
 - .3 Repeat required tests as directed.
 - .4 Correct defects and make additional tests until systems comply with contract requirements.
 - .5 Furnish instruments, appliances, connecting devices, equipment, personnel for tests.
 - .6 Authority of Jurisdiction will witness formal tests and approve systems before they are accepted.
- .2 Manufacturer Services:
 - .1 Obtain report from manufacturer verifying compliance of work of this Section as described in ACTION AND INFORMATIONAL SUBMITTALS in PART 1.
 - .2 Provide manufacturer's site services consisting of periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review work, as indicated in QUALITY ASSURANCE in PART 1.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11- Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Use the latest applicable editions (including addenda and updates) for the reference standards listed in all sections.

1.2 RELATED REQUIREMENTS

- .1 09 91 00 - Painting
- .2 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets. Include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada
 - .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 Drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .3 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, DCC Representative before final inspection.
 - .1 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.

- .2 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .3 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .4 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to DCC Representative for approval. Submission of individual data will not be accepted unless directed by DCC Representative .
 - .2 Make changes as required and re-submit as directed by DCC Representative .
- .5 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .6 Site records:
 - .1 Contractor shall provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .7 As-Built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to DCC Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .8 Submit copies of as-built drawings for inclusion in final TAB report.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One set of packing for each pump.

- .2 One casing joint gasket for each size pump.
- .3 One glass for each gauge glass.

1.6 DESIGN DOCUMENTS

- .1 The design drawings are partly diagrammatic, intended to convey the scope of work and indicate the general arrangement of systems. Off-sets in piping and ductwork may not be indicated in all cases, but are to be included in Contract as required.
- .2 The drawings are not intended to show Structural details ,Architectural features, or, Electrical interferences. Refer to Architectural ,Structural, and Electrical drawings for these details.
- .3 Drawings are diagrammatic. Do not scale plans to determine locations for equipment and materials.
- .4 Verify that there will be no obstructions or interferences caused by the Work of other Divisions or existing systems in advance of commencing Work.
- .5 All Sections to coordinate their Work with the Work of other Sections and other Divisions.

1.7 OMISSIONS AND DISCREPANCIES

- .1 The drawings and specifications are intended to describe complete working systems including all necessary labour and materials.
- .2 Bring obvious discrepancies or omissions to the attention of the DCC Representative during the tender period.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
 - .4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.9 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 dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not used.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pump installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 DEMONSTRATION

- .1 DCC Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Sump pumps

- .2 Domestic Hot Water Recirculating Pump
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 DCC Representative will record these demonstrations on video tape for future reference.

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 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of plumbing, sprinkler systems and related mechanical components and incidentals required to complete work described in this Section.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.3 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Reuse: Detach items from existing construction and deliver them to DCC Representative ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 RELATED REQUIREMENTS

- .1 Section 02 41 19 - Selective Demolition
- .2 Section 02 81 00 - Hazardous Materials

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section:

- .1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal
- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste .

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.7 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with the following:
 - .1 Ontario Workplace Safety and Insurance Board
 - .2 Ontario Occupational Health and Safety Act, R.S.O. 1990, c. O.1

1.8 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition.
- .2 Discovery of Hazardous Substances: Based on the third part Hazardous Substance Report it appears that Hazardous Substances may be encountered in the Work based on the sampling and results, refer to report in appendix. Immediately notify DCC Representative if materials suspected of containing hazardous substances are encountered and perform the following activities:
 - .1 Take all necessary precautions to protect workers and public safety until materials are confirmed to be non-hazardous, Refer to 01 70 12 - Safety Requirements.
 - .2 Initiate required process and documentation outlined in the Standard on the Management of Asbestos Containing Material in DND Immovables.
 - .3 Hazardous materials will be removed by DCC Representative before start of the Work.
 - .4 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify DCC Representative. Hazardous materials will be removed by DCC Representative under a separate contract or as a change to the Work.

1.9 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain DCC Representative's property

Part 2 Products

2.1 MATERIALS

- .1 General Patching and Repair Materials: Refer to Section 01 73 03 Execution Requirements and Section 02 41 19 Selective Demolition for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.
- .2 Plumbing Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction
- .3 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before beginning work.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Notify DCC Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
 - .3 Prevent debris from blocking drainage inlets.
 - .4 Protect mechanical systems that must remain in operation.

3.3 EXECUTION

- .1 Demolition and Removal: Coordinate requirements of this Section with information contained in Section 02 41 19 - Selective Demolition and as follows:
 - .1 Disconnect and cap mechanical services in accordance with requirements of local Authority Having Jurisdiction.
 - .2 Do not disrupt active or energized utilities without approval of the DCC Representative .
 - .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
 - .4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.
 - .5 At end of each day's work, leave worksite in safe condition.
 - .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

3.4 CLOSEOUT ACTIVITIES

- .1 DemolitionWaste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction in accordance with Section 01 35 43 Environmental Procedures.
- .2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances in accordance with requirements Section 02 81 00 - Hazardous Materials.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 05 00 – Common Work Results for Plumbing.
- .2 Section 22 10 10 - Plumbing Pumps.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI Z21.22/CSA 4.4, Relief Valves for Hot Water Supply Systems.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B64.10/B64.10.1, Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.
 - .2 CSA B79, Commercial and Residential Drains, and Cleanouts.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2020 (NPC).
- .5 Plumbing and Drainage Institute (PDI).
 - .1 PDI-WH201, Water Hammer Arresters Standard.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
 - .2 Indicate dimensions, construction details and materials for specified items.
 - .3 Submit WHMIS MSDS and indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada
 - .2 Submit shop drawings to indicate materials, finishes, method of anchorage, dimensions, construction and assembly details and accessories.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 CLOSEOUT SUBMITTALS:

- .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals, include:
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.5 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 manufacturers name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturers recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
 - .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in accordance with Section 01-74-19 - Waste Management and Disposal.

Part 2 Products

2.1 FLOOR DRAINS

- .1 Floor Drains and Trench Drains: to CSA B79.
 - .1 FD-1: Finished Area Drain; epoxy coated cast iron floor drain with anchor flange, weepholes, 6mm thick 127mm diameter nickel bronze strainer, no hub (MJ) outlet, trap seal primer connection.
 - .2 FD-2: Funnel Floor Drain; epoxy coated cast iron floor drain with anchor flange, weepholes, 6mm thick 127mm diameter nickel bronze strainer, 125x125mm oval nickel bronze funnel, no hub (MJ) outlet, trap seal primer connection.
 - .3 FD-3: Shower Drain; epoxy coated cast iron shower drain with 102x102mm square nickel bronze strainer, no hub (MJ) outlet, trap seal primer connection.
 - .4 FD-4: Hub Drain; epoxy coated cast iron floor drain with anchor flange, weepholes, adjustable nickel bronze hub funnel, no hub (MJ) outlet, trap seal primer connection.
 - .5 TD-1; Trench Drain; Stainless steel trench drain with stainless steel grate, integral sediment basket, anchor flanges, no hub (MJ) outlet.
- .2 Provide plumbing services as indicated on the plumbing fixture schedule and the drawings.
- .3 Do not prime floor drains from domestic cold water services supplying low flow faucets – 0.5 GPM.

2.2 CLEANOUTS

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 MJ clamps at cleanout covers is not acceptable, they must be bolted.
- .3 Access Covers:
 - .1 Wall Access: face or wall type, stainless steel, round cover with flush head securing screws, bevelled edge frame complete with anchoring lug.
 - .2 Floor Access: round, cast iron body and frame with adjustable secured nickel bronze top or cast box with anchor lugs and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: cast iron or nickel bronze, round gasket, vandal-proof screws.
 - .3 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

- .1 Stainless steel construction, bellows type: to PDI-WH201.
- .2 Size of each unit to suit the number of fixtures protected.
- .3 Install on hot and cold water supplies to washrooms with flush valve fixtures.

2.4 BACK FLOW PREVENTERS

- .1 Preventers: to CSA B64.10/B64.10.1, application as indicated, reduced pressure principle type, double check valve assembly or vacuum breaker.
- .2 Provide backflow preventers in the following locations:
 - .1 Make-up water to HVAC systems.
 - .2 Domestic cold water system – Premise.
 - .3 Sprinkler system.
- .3 Backflow preventers to be full line size, manufactured, tested and installed in accordance with CAN/CSA B64.10/B64.10.1.

2.5 VACUUM BREAKERS

- .1 Vacuum breakers: to CSA B64.10/B64.10.1, tested and rated under ANSI Z21.22, suitable for 15 PSI (100 kPa) steam service, 200 PSI (1380 kPa) water service with temperatures up to 250° F (121°C).
- .2 Install vacuum breakers at top of all domestic water risers, and at all fixtures having hose connections

2.6 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

2.7 DOMESTIC WATER HOSE REELS

- .1 Domestic Water Hose Reels; Heavy duty spring return c/w wall mounting bracket, guide arm, maximum 72 ° C (160 ° F) , 2050 kPa (300 psi) maximum operating pressure, hose end connection.

2.8 TRAP SEAL PRIMERS

- .1 Automatic brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection. Activated by a drop in water line pressure and sized to suit the number of traps served. Do not connect to cold water services supplying low flow faucets – 0.5 GPM.

2.9 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.

2.10 THERMOSTATIC MIXING VALVES

- .1 Provide point-of-use thermostatic mixing valves as indicated.
 - .1 MV-1 Single Fixture Applications: valve to be ASSE 1070 listed, bronze body with integral check valves and inlet screens, adjustment cap with locking feature to maintain mixed water temperature +/- 1-3°F, 12mm valve.
 - .2 Provide DHWR piping as close to valve as possible. Do not recirculate from the tempered water supply.

2.11 NEUTRALIZATION TANKS

- .1 Lightweight polyethylene resin seamless rectangular tank for surface installation with an inlet drop pipe. Tank to be equipped with a 75 mm diameter clean-out port for inspection.
- .2 Tank:
 - .1 T-1 – 1 1/2 Gallons, 40 mm inlet and outlet.

2.12 HAZARDOUS WASTE TANK

- .1 Closed top, HDPE construction manufactured to ASTM-D. Minimum 400 ø access service port, 100 ø flanged connections for fill, vent, equalization, drain, level, spare. Minimum 4500 litre capacity.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: verify that conditions of substrate previously installed under other sections or contracts are acceptable for plumbing specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC representative.
 - .2 Inform DCC representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada 2020 and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.5 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures.

3.6 BACKFLOW PREVENTERS

- .1 Install in accordance with CSA B64.10/B64.10.1, where indicated and elsewhere as required by code.
- .2 Pipe discharge to terminate over nearest floor drain or service sinks.
- .3 Install backflow preventer assemblies with a centerline height of between 750 - 1500 mm above finish floor level in accordance with CSA B64.10/B64.10.1.

3.7 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.8 DOMESTIC WATER HOSE REELS

- .1 Install in accordance with manufacturer's recommendation.

3.9 TRAP SEAL PRIMERS

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of DCC Representative.
- .3 Install soft copper or plastic tubing to floor drain.

3.10 STRAINERS

- .1 Install with sufficient room to remove basket c/w valving for servicing.

3.11 WATER MAKE-UP ASSEMBLY

- .1 Provide a bypass around make-up assembly equipped with a full line size backflow preventer. Install a pressure gauge downstream of assembly and bypass for manual throttling of pressure flow in bypass mode.
- .2 Pipe discharge from relief valve to nearest floor drain.

3.12 NEUTRALIZATION TANKS

- .1 Install in accordance with DHWT manufacturer's recommendation.
- .2 Pipe discharge to terminate over nearest floor drain or service sinks.

3.13 HAZARDOUS WASTE TANKS

- .1 Install in accordance with manufacturer's recommendation.
- .2 Provide valved & capped connection for pumper drain-down.

3.14 START-UP

- .1 Timing: start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
- .2 Provide continuous supervision during start-up.

3.15 TESTING AND ADJUSTING

- .1 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.

- .2 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
- .3 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .4 Floor drains:
 - .1 Verify operation of trap seal primer.
 - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
 - .3 Check operations of flushing features.
 - .4 Check security, accessibility, removability of strainer.
 - .5 Clean out baskets.
- .5 Vacuum breakers, backflow preventers:
 - .1 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
 - .2 Verify visibility of discharge from open ports.
- .6 Access doors:
 - .1 Verify size and location relative to items to be accessed.
- .7 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .8 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .9 Thermostatic mixing valves:
 - .1 Install as per manufacturer's recommendations.
 - .2 Verify temperature of tempered water.
- .10 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.

3.16 CLOSEOUT ACTIVITIES

- .1 Commissioning Reports: in accordance with Section 01 91 00 - Commissioning: reports, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 91 00 - Commissioning: Training of O&M Personnel, supplemented as specified.

3.17 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 19 - Waste Management and Disposal.

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

3.18 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section specifies the Contractor's responsibilities related to commissioning of plumbing systems and their contribution to the overall commissioning work specified in the Technical Sections of Division 01 of the Contract Documents.
- .2 Construction Team: Contractor is responsible for performing tests and verification activities specified in the relevant Sections of Division 22 of the Contract Documents, and submitting reports to Commissioning Authority.
 - .1 Subcontractors: plumbing subcontractors participate in commissioning activities in coordination with site quality control requirements for Work they are providing.
 - .2 Manufacturers: manufacturers assist verification activities and report on installation, performance and operation of the products/systems they supplied, as specified in the relevant Sections of Division 22.
 - .3 Contractor coordinates the work of subcontractors, with the commissioning requirements of this Section.
- .3 Commissioning Authority (CxA): the CxA may assign a commissioning specialist with expertise in building mechanical systems and controls, to undertake its commissioning responsibilities related to this Section.
- .4 The requirements of this Section do not replace testing requirements specified in the relevant Sections of Division 22 or reporting activities to demonstrate compliance with building code requirements to the authorities having jurisdiction.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA):
 - .1 CSA Z320- 11 , (R2016), Building Commissioning
 - .2 CSA Z5000- 18 , (R2018), Building Commissioning for Energy Using Systems

1.3 DEFINITIONS

- .1 Construction Team: the term Construction Team is used in this Section to designate inclusively the Contractor, subcontractors, manufacturers/suppliers and other support disciplines that are responsible for construction/installation of the Work specified in these specifications.
- .2 Cx Forms: forms used to document the inspections, tests and verification activities performed during the commissioning process, as specified in Section 01 91 00 – Commissioning
- .3 Cx Plan: a document developed under the responsibility of the CxA to specify the project's commissioning requirements, as specified in Section 01 91 00 –Commissioning
- .4 Cx Team: the commissioning team consists of project members that participate in the development, refinement and execution of the Cx Plan, as specified in Section 01 91 00 – Commissioning

1.4 ACRONYMS

- .1 BMM - Building Management Manual
- .2 CT – Construction Team
- .3 Cx - Commissioning
- .4 CxA – Commissioning Authority
- .5 EMCS - Energy Monitoring and Control Systems
- .6 FPT – Functional Performance Testing
- .7 O&M - Operation and Maintenance
- .8 TAB - Testing, Adjusting and Balancing

1.5 RELATED REQUIREMENTS

- .1 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Construction Team – Cx Representative: Contractor to designate a person from the Construction Team to review and coordinate commissioning activities specified in this Section.
 - .1 Representative to be acceptable to CxA with the following qualifications
 - .1 Site supervisor or project manager within the Construction Team, with direct responsibilities for supervising the execution of work specified in the relevant Sections Division 22
 - .2 Coordination: coordinate the responsibilities of the Construction Team in the Cx process with the responsibilities of other participants that form part of the Cx Team
 - .1 Coordinate the participation of plumbing subcontractors, inspection/testing agencies and manufacturers in reviewing the Cx Plan, submittals and in assisting testing and demonstration activities related to their work.
 - .2 Coordinate commissioning activities with execution of the work during the course of construction to allow Cx participants and the authority having jurisdiction to fulfill their responsibilities for witnessing tests and reviewing installation before concealment of work.
 - .3 Review interfaces with other work to ensure submittals and installation requirements are coordinated with other trades, including:
 - .1 Drainage requirements of fire suppression systems as specified in the relevant Sections of Division 21.
 - .2 Drainage requirements of HVAC equipment in the relevant Sections of Division 23 of the Contract Documents
 - .3 Electrical distribution serving plumbing equipment, including disconnects and starters, as specified in the relevant Sections of Division 26 of the Contract Documents

- .4 Notification: notify the CxA of activities associated with the commissioning process in accordance with Section 01 91 00 – Commissioning
- .5 Commissioning Conferences: arrange commissioning meetings attended by , CxA, Contractor and plumbing subcontractors in accordance with Section 01 91 00 –Commissioning and as follows:
 - .1 Before starting work: to review mock-up requirements and factory testing of systems, components and/or equipment.
 - .2 During execution of work but before start of commissioning activities: to refine the Cx Plan, commissioning documentation and commissioning schedule.
- .6 Sequencing: perform commissioning activities in general accordance with the commissioning process described in CSA Z320and CSA Z5000 , maintaining the systematic approach to completing and obtaining acceptance for each phase of commissioning in particular with regards to static verification, start-up and functional performance testing.
 - .1 Functional Performance Testing (FPT): perform operational and performance testing by phases starting with individual components and equipment, testing of sub-systems and then proceeding to FPT of overall systems.
 - .2 Integrated Systems: only perform commissioning of integrated systems once the FPT for each individual system forming part of the integrated system has been completed.
 - .3 Demonstration and training activities may form part of certain commissioning activities, as agreed by CxA

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures
- .2 Plumbing Cx Schedule
 - .1 Submit proposed schedule before start of commissioning conferences indicating key activities critical to the commissioning process including:
 - .1 Inspection of plumbing systems.
 - .2 Testing, flushing and cleaning of plumbing piping.
 - .3 TAB activities in coordination with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC .
 - .4 Commissioning phases: static verification, start-up, functional performance testing, systems orientation, O&M manuals submissions, training sessions.
 - .5 Integrated Testing activities.
 - .6 Review activities to be completed by other participants: CxA and the authority having jurisdiction.
 - .2 Review the proposed schedule through the course of the work and notify the CxA of modifications required

- .3 Commissioning Forms: Contractor to review and complete forms for documenting static verification and start-up activities in accordance with Section 01 91 00 –Commissioning
 - .1 Approved Cx Forms: CxA reviews and approves the final format to use through the commissioning process.
 - .1 Review the forms proposed by CxA and submit comments with proposed adjustments.
 - .2 Contractor may submit its own preferred format for review by the CxA. This may include manufacturer provided checklists.
 - .2 Submit completed static verification and start-up checklists within 48 hours of completion of verification of equipment or system.
- .4 Testing Equipment: submit a list of proposed testing equipment for performing plumbing Cx activities and related tests in accordance with Section 01 91 00 –Commissioning
- .5 Site Quality Control Submittals: submit manufacturers written certificates and reports demonstrating compliance of Work, as specified in the relevant Sections of Division 22.
- .6 Training Program: submit proposed training program and materials in accordance with Section 01 79 00 – Demonstration and Training

1.8 CLOSEOUT SUBMITTALS

- .1 Submit O&M data and as-built information in accordance with Section 01 78 00 – Closeout Submittals
 - .1 Site Modifications: record changes to installations, system configuration and/or controls that were made during the commissioning process to meet the required performance of plumbing equipment and systems.

Part 2 Products

2.1 EQUIPMENT

- .1 Furnish special tools or equipment required for:
 - .1 Verifying or adjusting equipment/system components.
 - .2 Accessing equipment, enclosures or control cabinets.
 - .3 Interfacing with equipment controls or integrated system diagnostics
- .2 Furnish instruments and equipment required to perform testing and validate performance of plumbing systems through the commissioning process or as specified in the relevant Sections of Division 22.

Part 3 Execution

3.1 STATIC VERIFICATION

- .1 Perform static verification of components, equipment and systems in accordance with Section 01 91 00 – Commissioning and complete the approved Cx Forms in coordination with performing the following activities.
 - .1 Verify installation and connection of equipment, sub-systems and systems.

- .2 Confirm proper location of valves, sensors, and control components in accordance with design and O&M requirements.
- .3 Confirm accessibility to plumbing equipment, components, devices and cleanouts for inspection and O&M activities.
- .4 Confirm that exposed aesthetic components, such as chromed plated piping and escutcheons, are installed in compliance with specifications.
- .5 Conduct hydrostatic pressure testing of plumbing piping and report results.
- .6 Record equipment and systems information including: manufacturer, model number, serial number and rated capacities.
- .7 Confirm completion of labelling and identification of piping, valves, equipment, and control components.
- .8 Confirm that dielectric couplings have been provided for connections between dissimilar metals.
- .9 Confirm completion and documentation of equipment prestart-up tests, including manufacturer's factory tests.
- .10 Confirm that floor drain placement and sloping of finished floors comply with design requirements and adequately capture water from potential floods in the space.
- .11 Confirm that thermal insulation of plumbing systems and equipment is completed in accordance with design requirements.
- .12 Confirm that drain caps and drain covers are installed.
- .13 Confirm seismic and vibration controls for plumbing equipment/systems are installed in accordance with design details and manufacturer's recommendations.
- .2 Site Quality Control: CxA to conduct random verification on-site to validate the accuracy of static verification reporting. Contractor to assist the CxA on site to review selected samples representing up to 30 % of the overall installation.

3.2 START-UP

- .1 Perform start-up of equipment and systems in accordance with Section 01 91 00 – Commissioning and complete the approved Cx Forms in coordination with performing the following activities:
 - .1 Flushing and cleaning of plumbing piping.
 - .2 Contractor/manufacturer start-up of equipment.
 - .3 Electrical start-up including site electrical tests and verification of overloads and motor rotation.
 - .4 Start-up of domestic water treatment systems, such as water softeners and filtration equipment.
 - .5 Visual and mechanical inspections following equipment start-up.
 - .6 Domestic water sanitization and water sample testing.
 - .7 Verify operation of safety controls and interlocks.
 - .8 Complete inspections required by authorities having jurisdiction (AHJ).
 - .9 Measure temperature performance for plumbing systems.

- .10 Setup and adjustment of booster pumping systems for proper pressure and operation.
- .11 Adjustment of thermostatic mixing valves to provide design supply temperatures.
- .2 Site Quality Control: CxA will witness start-up activities for selected equipment. Notify the CxA of start-up activities in accordance with Section 01 91 00 –Commissioning

3.3 FUNCTIONAL PERFORMANCE TESTING

- .1 Perform Functional Performance Testing (FPT) on plumbing equipment and systems in accordance with Section 01 91 00 – Commissioning and as directed by the CxA .
- .2 Operate equipment as directed by CxA to demonstrate and validate that equipment, sub-systems and systems function and perform in accordance with design requirements.
- .3 FPT activities to include the following:
 - .1 Verify proper operation of plumbing systems and equipment in the following modes of operation
 - .1 Systems operation on normal power.
 - .2 Normal operation – no alarm conditions.
 - .3 Systems operation in alarm condition.
 - .4 Manual operation mode.
 - .5 Automatic operation mode.
 - .2 Verify operation of safety cutouts, alarms and interlocks.
 - .3 Confirm alarms are generated and transmitted effectively to the intended notification system (e.g. pilot light, control panel, EMCS, remote surveillance system).
 - .4 Verify operation and flowrate of sanitary water sump pumps in all modes of operation including lead pump failures and alternating pump functions.
 - .5 Verify time required for hot water delivery to plumbing fixtures.
 - .6 Verify that plumbing fixture flowrates comply with design requirements.
 - .7 Confirm that temperature of domestic hot water storage equipment comply with design requirements.
 - .8 Verify that the proper schedules were configured for plumbing equipment and confirm that systems are disabled when not required.
 - .9 Verify TAB results in coordination with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC .
 - .10 Verify and adjust system response to:
 - .1 Power failure.
 - .2 Loss of natural gas service.
 - .3 Loss of domestic water supply.

3.4 CLOSEOUT ACTIVITIES

- .1 Corrections: Provide equipment, materials and labor as required to correct installation and/or equipment deficiencies identified through the commissioning process

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for plumbing pumps.

1.2 REFERENCE STANDARDS

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

1.3 RELATED REQUIREMENTS

- .1 Section 22 11 16 - Domestic Water Piping.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
 - .2 Submit WHIMIS SDS. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings.
 - .1 Submit shop drawings to indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
 - .2 Wiring and schematic diagrams.
 - .3 Dimensions and recommended installation.
 - .4 Pump performance and efficiency curves.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00- Closeout Submittals, include:
 - .1 Manufacturers name, type, model year, capacity and serial number.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list with names and addresses.

1.6 QUALITY ASSURANCE

- .1 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal: Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS

- .1 Capacity: as indicated.
- .2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 105 degrees C continuous service.
- .3 Motor: drip-proof, with thermal overload protection.
- .4 Supports: provide as recommended by manufacturer.

2.2 SUMP PUMP SUBMERSIBLE

- .1 Capacity: as indicated.
- .2 Construction: duplex CSA approved, housing epoxy coated cast iron, stainless steel hardware and shaft, non-clog bronze impeller, mechanical shaft seal.
- .3 Motor: as indicated, hermetically sealed, with automatic overload protection.
- .4 Control: mercury switches and duplex control panel c/w high level and failure alarms-audible and visual, alternating control.
- .5 Guide rail assembly with lifting mechanism, isolation and check valve.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Ensure pump and motor assembly do not support piping.
- .3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

3.3 SITE QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Check power supply.
 - .2 Check starter protective devices.
- .2 Start-up, check for proper and safe operation.
- .3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .4 Adjust flow from water-cooled bearings.
- .5 Adjust impeller shaft stuffing boxes, packing glands.

3.4 START-UP

- .1 Refer to Section 01 91 00 - General Commissioning for commissioning requirements.
- .2 General: In accordance with Section 01 91 00 - Commissioning: General Requirements, supplemented as specified herein.
 - .1 Procedures:
 - .1 Check power supply.
 - .2 Check starter O/L heater sizes.
 - .3 Start pumps, check impeller rotation.
 - .4 Check for safe and proper operation.
 - .5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
 - .6 Test operation of hands-on-auto switch
 - .7 Test operation of alternator
 - .8 Adjust alignment of piping and conduit to ensure full flexibility.
 - .9 Eliminate causes of cavitation, flashing, air entrainment.

3.5 DOMESTIC HW CIRCULATING PUMPS

- .1 Provide horizontal in-line domestic hot water circulating pumps where shown.

- .2 Install the pumps in place in vertical piping approximately 1.2 m (4') above the floor in accordance with the pump manufacturer's instructions.

3.6 PV - SUBMERSIBLE PUMPS

- .1 Application tolerances:
 - .1 Flow: plus 10%; minus 0%.
 - .2 Pressure: plus 10%; Minus 5%.
- .2 PV Procedures:
 - .1 Fill sump at rate slower than capacity of pump #1.
 - .2 Record levels at which pump #1 starts and stops. Determine flow rate by observing time taken to down water level.
 - .3 Fill sump at rate faster than capacity of pump #1 but slower than capacities of pumps #1 and #2 operating in parallel.
 - .4 Record levels at which pumps start and stop - water level rising and water level falling.
 - .5 Verify operation of alternator.
 - .6 Adjust water level controls as necessary.
 - .7 Fill sump at rate faster than capacities of pumps #1 and #2 operating in parallel.
 - .8 Record levels at pump starts and stops - water level rising and falling.
 - .9 Check operation of alternator.
 - .10 Adjust level controls as necessary.
 - .11 Check level at which high water level alarm starts and stops. Adjust as necessary.
- .3 Check removability of pumps for servicing without interfering with installation or operation of other equipment.
- .4 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

3.7 REPORTS

- .1 In accordance with 01 91 00 - Commissioning: reports, supplemented as specified.
- .2 Include:
 - .1 PV results on approved PV Report Forms.
 - .2 Product Information report forms.
 - .3 Pump performance curves (family of curves) with final point of actual performance.

3.8 TRAINING

- .1 In accordance with 01 91 00 - Commissioning: Training of O&M Personnel, supplemented as specified.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 22 05 00 – Common Work Results for Plumbing.
- .2 Section 23 05 15 – Common Installation Requirements for HVAC Pipework.
- .3 Section 23 05 23.01 – Valves – Bronze.
- .4 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, c. 33 (CEPA).
- .5 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.

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 datasheets for product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS:

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with DCC Representative's requirements.
- .2 Packaging Waste Management:
 - .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
 - .3 Alternate piping system – Press fit domestic water piping system

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast copper alloy threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GATE VALVES

- .1 NPS 2 and under, soldered:
 - .1 Rising stem: to MSS SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves – Bronze.

- .2 NPS 2 and under, screwed:
 - .1 Rising stem: to MSS SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves – Bronze.

2.5 GLOBE VALVES

- .1 NPS2 and under, soldered:
 - .1 To MSS SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 – Valves – Bronze.
 - .2 Lock shield handles: as indicated.
- .2 NPS 2 and under, screwed:
 - .1 To MSS SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 – Valves – Bronze.
 - .2 Lock shield handles: as indicated.

2.6 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves – Bronze.
- .2 NPS 2 and under, screwed:
 - .1 To MSS SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves – Bronze.

2.7 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 – Valves – Bronze.
- .2 NPS 2 and under, soldered:
 - .1 To ANSI/ASME B16.18, Class 150.
 - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 – Valves – Bronze.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code 2020 and local authority having jurisdiction.

- .2 Install pipe work in accordance with Section 23 05 15 – Common Installation Requirements for HVAC Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install DCW piping below and away from DHW and DHWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
 - .1 Underground copper piping in protective conduit to lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .7 VALVES
 - .1 Isolate equipment, fixtures and branches with gate valves.
 - .2 Balance domestic hot water recirculation system using lock shield globe valves. Mark settings and record on as-built drawings on completion. Each domestic hot water recirculation branch to be provided with a gate, check and lock shield globe valve.

3.3 PRESSURE TESTS

- .1 Conform to requirements of Section 23 05 15 – Common Installation Requirements for HVAC Pipework.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

- .1 Flush entire system for 8 hours. Ensure outlets flushed for 2 hours and sterilize all potable water systems. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.
- .2 Submit all test results to DCC Representative.

3.5 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of DCC Representative.

- .2 Upon completion, provide laboratory test reports on water quality for DCC Representative approval.

3.7 START-UP

- .1 Timing: Start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring DHW heaters and storage tanks up to design temperature slowly.
 - .4 Monitor piping DHW, DHWR and DCW piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

- .1 Scheduling:
 - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 TAB DHWR in accordance with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
 - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .4 Sterilize DHW, DHWR and DCW systems for Legionella control.
 - .5 Verify performance of temperature controls.
 - .6 Verify compliance with safety and health requirements.
 - .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
 - .1 In accordance with Section 01 91 00 - Commissioning: Reports, using report forms as specified.
 - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.9 OPERATION REQUIREMENTS

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 15 – Common Installation Requirements for HVAC Pipework.
- .2 Operational requirements in accordance with Division 01: requirements, include:
 - .1 Cleaning materials and schedules.
 - .2 Repair and maintenance materials and instructions.

3.10 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 – Common Product Requirements
- .3 Section 01 74 11 – Cleaning

1.2 REFERENCES

- .1 ASTM International Inc. (ASTM):
 - .1 ASTM B32, Standard Specification for Solder Metal.
 - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .2 CSA B125.3, Plumbing Fittings.
- .3 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2020 (NPC).
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

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 datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SUSTAINABLE MATERIAL

- .1 Sustainable Requirements: materials and products in accordance with Division 01.
 - .1 Maximum VOC limit to SCAQMD Rule 1168.

2.2 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary, storm and vent, NPS 1-1/2 and smaller: Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CSA B125.3.
 - .2 Wrought copper: to CSA B125.3.
 - .2 Solder: tin-lead, 50:50, type 50A, to ASTM B32.
 - .3 Pumped systems capable of withstanding 1.5 times pump head and NPC minimum.

2.3 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary and vent minimum NPS 3, to: CAN/CSA-B70.
 - .1 Joints:
 - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70 or ASTM C564.
 - .2 Stainless steel clamps.
 - .2 Above ground sanitary and vent, NPS 2 and larger: to CSA B70.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 In accordance with Section 23 05 15 - Common installation requirements for HVAC pipework.
- .2 Install in accordance with National Plumbing Code 2020 and local authority having jurisdiction.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Pressure test pumped systems before final connection.
- .3 Hydraulically test to verify grades and freedom from obstructions.
- .4 Perform dye tests as required by the local authority having jurisdiction.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .3 Test to ensure traps are fully and permanently primed.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 05 00 – Common Work Results for Plumbing.
- .2 Section 23 05 15 – Common Installation Requirements for HVAC Pipework.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B1800, Thermoplastic Nonpressure Piping Compendium (Consists of B181.0, B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2020 (NPC).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

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 datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide two copies WHMIS MSDS – Material Safety Data Sheets in accordance with Section 01 70 12 – Safety Requirements and Section 01 35 43 – Environmental Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.

- .4 Packaging Waste Management: remove for reuse of pallets, crates, paddling and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 PIPING AND FITTINGS

- .1 For buried sanitary, storm and vent, NPS 3 and smaller - ABS, NPS 4 and larger - PVC piping to:
 - .1 CAN/CSA B1800.
 - .2 Minimum underground NPS 3.

2.2 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564. Maximum VOC Content: 510 g/L (less water).
- .2 Solvent weld for ABS: to ASTM D2235. Maximum VOC Content: 325 g/L (less water).

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 In accordance with Section 23 05 15 – Common Installation Requirements for HVAC Pipework.
- .2 Install in accordance with National Plumbing Code 2020 and local authority having jurisdiction.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.
- .3 Perform dye tests as required by the local authority having jurisdiction.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify cleanout rods can probe as far as the next cleanout, at least.

- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME):
 - .1 ASME B16.5-17, Pipe Flanges and Flanged Fittings
 - .2 ASME B16.11-16, Forged Fittings, Socket-Welding and Threaded
- .2 ASTM International (ASTM):
 - .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - .2 ASTM A181/A181M-14, Standard Specification for Carbon Steel Forgings for General Purpose Piping
- .3 CSA Group (CSA):
 - .1 CSA B51:19, Boiler, Pressure Vessel, and Pressure Piping Code
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.2 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC

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, specifications and datasheet for piping, fittings and equipment.
 - .2 Submit WHMIS. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings:
 - .1 Submit shop drawings to indicate project layout including layout, dimensions and extent of piping system.
 - .1 Vertical and horizontal piping locations and elevations and connections details.
 - .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .4 Instructions: submit manufacturer's installation instructions.
- .5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with DCC Representative's requirements.
- .2 Packaging Waste Management:
 - .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 COMBINATION FILTER-REGULATOR

- .1 Factory assembled, heavy-duty with mounting bracket and low pressure side relief valve.
- .2 Maximum inlet pressure: 800 kPa.
- .3 Operating temperature: minus 18 degrees C to plus 72 degrees C.
- .4 Filter element: 40 micron. Bowls: polycarbonate.
- .5 Pressure range in regulator: 34 kPa to 800 kPa.
- .6 Gauge range: 0 kPa to 1100 kPa.

2.2 PIPING

- .1 Piping: to ASTM A53/A53M, schedule 80 seamless black steel
- .2 Fittings:
 - .1 NPS2 and smaller: to ASME B16.11, schedule 80 steel, socket welded
- .3 Couplings: to ASME B16.11, socket welded or threaded half coupling type
- .4 Unions: 1000 kPa malleable iron with brass-to-iron ground seat.
- .5 Dissimilar metal junctions: use dielectric unions.
- .6 Flanges:
 - .1 NPS2 and smaller: to ASME B16.5, forged steel, raised face and socket welded
- .7 Joints:
 - .1 NPS2 and smaller: socket welded.

2.3 BALL VALVES

- .1 Three piece design or top entry for ease of in-line maintenance.
 - .1 To ASTM A181/A181M, Class 70, carbon steel body socket welded or screwed ends, carbon steel ball and associated trim suitable for compressed air application.
 - .2 To withstand 1034 kPa maximum pressure.

2.4 HOSE REELS

- .1 Swivel type heavy duty spring return c/w wall mounting bracket and guide arm.
- .2 Suitable for operation in space temperature at 72 ° C (160 ° F) , 2050 kPa (300 psi) maximum operating pressure.
- .3 Quick connect for HVLP paint spray gun.
- .4 Hose length; 7.6m and 15.2m, as shown on plans.

2.5 COUPLERS/CONNECTORS

- .1 Industrial interchange series, full-bore.
- .2 Maximum inlet pressure: 1700 kPa.
- .3 Valve seat: moulded nylon.
- .4 Body: zinc plated steel.
- .5 Threads: NPT.

Part 3 EXECUTION

3.1 AIR PRESSURE FILTER REGULATORS

- .1 Install regulators as indicated.

3.2 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION

- .1 Install shut-off valves at outlets, major branch lines and in locations as indicated.
- .2 Install quick-coupler chucks and pressure gauges on drop pipes.
- .3 Install unions to permit removal or replacement of equipment.
- .4 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.
- .5 Grade piping at 1% slope minimum.
- .6 Install compressed air trap and pressure equalizing pipe at moisture collecting points.
- .7 Make branch connections from top of main.
- .8 Install compressed air trap at bottom of risers and at low points in mains, piped to nearest drain. Distance between drain points to be 30 m maximum.
- .9 Weld steel piping in accordance with;
 - .1 ASME code and requirements of authority having jurisdiction
 - .2 Weld concealed and inaccessible piping regardless of size.

3.3 SITE QUALITY CONTROL

- .1 Site Tests and Inspections:
 - .1 Testing: pressure test for 4 hours minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.
- .2 Check entire installation is approved by authority having jurisdiction

3.4 CLEANING

- .1 Perform cleaning operations as specified in Section 01 74 11 - Cleaning and in accordance with manufacturer's recommendations.
 - .1 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.
- .2 Waste Management and Disposal: Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete.
- .2 Section 22 05 00 – Common Work Results for Plumbing.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI/ASHRAE/IES).
- .2 Canadian Standards Association (CSA International)
 - .1 CSA ANSI Z21.10.3-2017/CSA 4.3-2017; Gas Water Heaters - Volume III, Storage Water Heaters, With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous
 - .2 CSA B149.1-20, Natural Gas and Propane Installation Code.
- .3 National Research Council Canada (NRC):
 - .1 National Plumbing Code of Canada 2020 (NPC)

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 datasheets for product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies, wiring diagrams and ancillaries, identifying factory and field assembled.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

- .3 Packaging Waste Management: remove for reuse of pallets, crates, paddling and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GAS FIRED WATER HEATERS

- .1 To ANSI Z21.10.3/CSA 4.3.
- .2 Natural gas water heater, 95% thermal efficiency, seamless glass lined steel tank construction, foam insulation, down-fired power burner, 0" clearance to combustibles, maintenance-free powered anode, submerged combustion chamber with spiral heat exchanger, power venting c/w neutralizer kit for condensate drain; ASHRAE 90.1 compliant.
- .3 Provide ULC-S636 listed CPVC exhaust and air intake piping (individually vented to the roof level), supplied by domestic hot water heater manufacturer.
- .4 Control: Integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display and digital temperature readout.
- .5 Gas burner: Complete with high-limit control, gas valve, gas pressure regulator, 100% safety shut-off.
- .6 3 year warranty certificate.
- .7 Heater capacity: Refer to schedule on drawings.
- .8 ASME rated expansion tank: Refer to schedule on drawings.

2.2 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer and shut-off cock.
- .4 Thermowell filled with conductive paste for control valve temperature sensor.
- .5 ASME rated temperature and pressure relief valve sized for full capacity of heater(s), with discharge terminating over floor drain and visible to operators.

2.3 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation in concrete support pad in accordance with Section 03 30 00 – Cast-in-Place Concrete.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Provide insulation between tank and supports.
- .3 Install natural gas fired domestic water heaters in accordance with CSA B149.1.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's factory trained, certified representative to start up and commission DHW heaters.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 05 00 – Common Work Results for Plumbing.
- .2 Section 22 42 20 – Commercial Emergency Showers.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45, Plumbing Fixtures, includes updates.
 - .2 CSA B125.3, Plumbing Fittings.
 - .3 CSA B651, Accessible Design for the Built Environment, includes updates.
- .2 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36, Commercial Adhesives.
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2020 (NBC).
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

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 datasheets for washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Indicate fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.
 - .2 Factory-set water consumption per flush at recommended pressure.
 - .3 (For water closets, urinals): minimum pressure required for flushing.
- .4 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, paddling and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal .

Part 2 Products

2.1 SUSTAINABLE MATERIAL

- .1 Adhesives and sealants: maximum VOC limit to SCAQMD Rule 1168.

2.2 MANUFACTURED UNITS

- .1 Plumbing fixtures and trim supplied by DCC Representative, installed by mechanical contractor as identified in this section.
- .2 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .3 Trim, fittings: manufacture in accordance with CSA B125.3.
- .4 Exposed plumbing brass to be chrome plated.
- .5 Number, locations: architectural drawings to govern.
- .6 Fixtures and trim in any one location to be product of one manufacturer and of same type.
- .7 Plumbing services to fixtures as indicated in the Plumbing Fixture Schedule.
- .8 Water closets:
 - .1 WC-1: wall-mounted, exposed flush valve, top spud.
 - .1 Bowl: American Standard Madera model supplied by DCC Representative, installed by mechanical contractor
 - .2 Flush valve: Delta model 81T201 supplied by DCC Representative, installed by mechanical contractor.
 - .3 Contractor shall provide floor mounted wall carrier.

- .2 WC-2: Barrier free wall-mounted, exposed flush valve, top spud.
 - .1 Bowl: American Standard Madera model supplied by DCC Representative, installed by mechanical contractor
 - .2 Flush valve: Delta model 81T201 supplied by DCC Representative, installed by mechanical contractor.
 - .3 Contractor shall provide floor mounted wall carrier.
- .9 Urinal:
 - .1 UR-1: wall mounted, battery flush valve, top spud,.
 - .1 Fixture: American Standard Washbrook model supplied by DCC Representative, installed by mechanical contractor
 - .2 Flush valve: Delta model 81T231BTA supplied by DCC Representative, installed by mechanical contractor.
 - .3 Contractor shall provide heavy duty wall hanger suitable for block wall installation.
 - .2 UR-2: Barrier free wall mounted, battery flush valve, top spud.
 - .1 Fixture: American Standard Washbrook model supplied by DCC Representative, installed by mechanical contractor
 - .2 Flush valve: Delta model 81T231BTA supplied by DCC Representative, installed by mechanical contractor.
 - .3 Contractor shall provide heavy duty wall hanger suitable for block wall installation.
- .10 Washroom Lavatories:
 - .1 LAV-1:
 - .1 Barrier free, counter top vitreous china, white, self-rimming, with front overflow.
 - .2 Fixture: American Standard Colony model supplied by DCC Representative, installed by mechanical contractor
 - .3 Lavatory trim: Delta model 21T142 supplied by DCC Representative, installed by mechanical contractor.
 - .4 Mixing valve:
 - .1 Provided by mechanical contractor.
 - .2 Point of use mechanical mixing valve, lead free brass body, temperature limit adjustment to 48 ° C.
 - .2 LAV-2:
 - .1 Barrier free, wall mounted c/w drain shroud, vitreous china, white, self-rimming, with rear overflow, rectangular bowl, 100Ø centreset. Sizes: 545 x 540 mm outside, 400 x 540 mm nominal inside.
 - .2 Lavatory trim: Chrome plated brass, surface mounted supply fitting, gooseneck mixing spout, aerator, indexed metal lever handle:
 - .3 Provide accessories to limit maximum flow rate to 3.8 l/minute at 413 kPa.

- .4 Waste fitting: open grid strainer.
 - .5 Mixing valve:
 - .1 Point of use mechanical mixing valve, lead free brass body, temperature limit adjustment to 48 ° C.
- .11 Fixture piping:
 - .1 Hot and cold water supplies to fixtures:
 - .1 Chrome plated rigid supply pipes with screwdriver stop, reducers, escutcheon.
 - .2 Waste:
 - .1 Brass P trap with clean out on fixtures not having integral trap.
 - .2 Chrome plated in exposed places.
 - .3 Insulated or shroud for barrier free applications
- .12 Chair carriers:
 - .1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for washroom fixtures installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 APPLICATION

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

3.3 INSTALLATION

- .1 Mounting heights:
 - .1 Wall-hung fixtures: as indicated on architectural drawings, measured from finished floor.
 - .2 Barrier free: to most stringent of either NBC 2020 or CSA B651.
 - .3 Confirm all fixture heights with DCC Representative prior to installation.

3.4 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
 - .3 Adjust flush valves to suit actual site conditions.

- .4 Adjust urinal flush timing mechanisms.
- .5 Set controls of automatic flush valves for urinals to prevent unnecessary flush cycles.
- .3 Checks:
 - .1 Water closets, urinals: flushing action.
 - .2 Aerators: operation, cleanliness.
 - .3 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal .

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 05 00 – Common Work Results for Plumbing.

1.2 REFERENCES

- .1 American Society of Sanitary Engineering (ASSE)
 - .1 ASSE 1016, Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45, Plumbing Fixtures, includes updates.
 - .2 CSA B125.3, Plumbing Fittings.
 - .3 CSA B651, Accessible Design for the Built Environment, includes updates.
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2020 (NBC).

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 datasheets for product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse of pallets, cradles and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal .

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Plumbing fixtures and trim supplied by DCC Representative, installed by mechanical contractor.
 - .1 Shower based provided by mechanical contractor.
- .2 Number, locations: architectural drawings to govern.
- .3 Plumbing services to fixtures as indicated in the Plumbing Fixture Schedule.
- .4 Showers.
 - .1 SH-1: Individual shower stall.
 - .1 900x900x100 pre-cast terrazzo base provided by mechanical contractor.
 - .2 Moen model T3291 supplied by DCC Representative, installed by mechanical contractor.
 - .2 SH-2: Barrier free individual shower stall.
 - .1 1350x900x100 pre-cast terrazzo base provided by mechanical contractor.
 - .2 Moen model T3291 supplied by DCC Representative, installed by mechanical contractor.
- .5 Fixture piping:
 - .1 Hot and cold water supplies to each fixture.
 - .1 Chrome plated flexible supply pipes in exposed areas.
 - .2 Waste:
 - .1 Brass P trap with cleanout on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Mounting heights:
 - .1 Wall-hung fixtures: as indicated on architectural drawings, measured from finished floor.
 - .2 Barrier free: to comply with most stringent of either NBC 2020 or CSA B651.
 - .3 Confirm all fixture heights with DCC Representative prior to installation.

3.3 ADJUSTING

- .1 Conform to water conservation requirements specified this section.

- .2 Adjustments:
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:
 - .1 Aerators: operation, cleanliness.
 - .2 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal .

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 05 00 – Common Work Results for Plumbing.

1.2 REFERENCES

- .1 American Society of Sanitary Engineering (ASSE)
 - .1 ASSE 1016, Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45, Plumbing Fixtures, includes updates.
 - .2 CSA B125.3, Plumbing Fittings.
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2020 (NBC).

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 datasheets for product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal .

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Combo emergency shower and eye/face wash:
 - .1 EDS-1: corrosion PVC plastic with an antimicrobial treatment on the eye/face wash head – push flag activated, ABS plastic shower head – pull lever activated, 3.7 GPM flow control on eye/face wash, 20 GPM flow control on shower head, 11” round ABS plastic bowl, stainless steel shower and eyewash ball valves, green epoxy finish, schedule 80 PVC 2-1/2” floor flange, schedule 80 PVC plastic vertical piping, 3-sided high visibility universal sign, 1-1/4” IPS supply and 1-1/2” waste.
 - .2 MV-1: emergency tempering valve to ASSE 1071 with cold water bypass, precise temperature control over a wide range of flow conditions and effectively shut down on loss of cold water service, factory set to 29° C with a lockable means of securing the temperature, triple duty check-stops, temperature/pressure gauge on outlet, valve to be rough bronze in a surface mounted stainless steel cabinet, 20mm inlets – 25mm outlet.
- .2 Fixture piping:
 - .1 Hot and cold water supplies to each fixture.
 - .1 Chrome plated flexible supply pipes in exposed areas.
 - .2 Waste:
 - .1 Brass P trap with cleanout on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Mounting heights:
 - .1 Confirm fixture installation details with DCC Representative prior to installation.

3.3 ADJUSTING

- .1 Adjustments:
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .2 Checks:
 - .1 Vacuum breakers, backflow preventers: operation under all conditions.

- .3 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal .

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Use of mechanical systems during construction.

2.1 USE OF SYSTEMS

- .1 Use of permanent heating and ventilating systems for supplying temporary heat is permitted only under following conditions:
 - .1 Entire system is complete, pressure tested, cleaned, flushed out.
 - .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
 - .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
 - .4 There is no possibility of damage.
 - .5 Supply ventilation systems are protected by 60% filters, inspected daily, changed every week or more frequently as required.
 - .6 Return systems have approved filters over openings, inlets, outlets.
 - .7 Systems will be:
 - .1 Operated as per manufacturer's recommendations and instructions.
 - .2 Operated by Contractor.
 - .3 Monitored continuously by Contractor.
 - .8 Warranties and guarantees are not relaxed.
 - .9 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of DCC Representative.
 - .10 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.
- .2 Filters specified in this Section are over and above those specified in other Sections of this project.
- .3 Exhaust systems are not included in approvals for temporary heating ventilation.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, product literature, and data sheets for products and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .3 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify Section and paragraph number.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data and incorporate into manual.
 - .1 Operation and maintenance manual approved by, and final copies submitted to DCC Representative before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .3 Maintenance data to include:

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- .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .4 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .5 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to DCC Representative for approval. Submission of individual data will not be accepted unless directed by DCC Representative.
 - .2 Make changes as required and re-submit as directed by DCC Representative.
 - .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .7 Site records:
 - .1 DCC Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
 - .8 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to DCC Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals
- .2 Supply spare parts as follows:
- .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
 - .4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Supply one set of special tools required to service equipment as recommended by manufacturers.
- .4 Supply one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packaging Waste Management: Perform in accordance with Section Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for Paint Booth and related equipment installation in accordance with manufacturer's instructions.
- .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 SITE QUALITY CONTROL

- .1 Manufacturer's Site Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Site Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

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

3.3 ADJUSTING

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Perform painting in accordance with Section 09 91 00 - Painting.
- .3 Restore finishes which have been damaged to a "like new" condition.

3.4 CLEANING

- .1 Final Cleaning: Perform in accordance with Section 01 74 11 - Cleaning and clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.5 DEMONSTRATION

- .1 DCC Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Paint Booth assembly, including associated make-up air unit, exhaust fan, controls, and related accessories.
 - .2 Indoor make-up air unit.
 - .3 Fans
 - .4 Domestic Hot Water Tank
 - .5 Air Curtains.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate Sections.
- .6 DCC Representative will record these demonstrations for future reference.

3.6 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of heating, ventilation and air conditioning systems, controls and automated automation components, and related mechanical components and incidentals required to complete work described in this Section.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.3 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Reuse: Detach items from existing construction and deliver them to DCC Representative ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 RELATED REQUIREMENTS

- .1 Section 02 41 19 - Selective Demolition
- .2 Section 02 81 01 - Hazardous Materials

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section:

- .2 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal.
- .3 Landfill Records: Indicate receipt and acceptance of selective demolition waste.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.7 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with the following:
 - .1 Ontario Workplace Safety and Insurance Board
 - .2 Ontario Occupational Health and Safety Act, R.S.O. 1990, c. O.1

1.8 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted at time of site examination before tendering
- .2 Discovery of Hazardous Substances: Based on the third part Hazardous Substance Report it appears that Hazardous Substances may be encountered in the Work based on the sampling and results, refer to report in appendix. Immediately notify DCC Representative if materials suspected of containing hazardous substances are encountered and perform the following activities:
 - .1 Take all necessary precautions to protect workers and public safety until materials are confirmed to be non-hazardous, Refer to 01 70 12 - Safety Requirements.
 - .2 Initiate required process and documentation outlined in the Standard on the Management of Asbestos Containing Material in DND Immovables.
 - .3 Hazardous materials will be removed by DCC Representative before start of the Work.
 - .4 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify DCC Representative. Hazardous materials will be removed by DCC Representative under a separate contract or as a change to the Work.

1.9 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain DCC's property
- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of materials in accordance with Section 02 41 19 – Selective Demolition.

Part 2 Products

2.1 MATERIALS

- .1 General Patching and Repair Materials: Refer to Section 01 73 03 Execution Requirements and 02 41 19 Selective Demolition for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.
- .2 HVAC Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.
- .3 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before beginning work.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Notify DCC Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
 - .3 Prevent debris from blocking drainage inlets.
 - .4 Protect mechanical systems that must remain in operation.

3.3 EXECUTION

- .1 Demolition and Removal: Coordinate requirements of this Section with information contained in Section 02 41 19 - Selective and as follows:
 - .1 Disconnect and cap gas supply and electrical services in accordance with requirements of local Authority Having Jurisdiction.
 - .2 Do not disrupt active or energized utilities without approval of the DCC Representative .
 - .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
 - .4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.

- .5 At end of each day's work, leave worksite in safe condition.
- .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

3.4 CLOSEOUT ACTIVITIES

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for reuse in new construction
- .2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances in accordance with requirements of Section 02 81 01 - Hazardous Materials

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 - Quality Control
- .3 Section 01 61 00 - Common Product Requirements
- .4 Section 01 74 11 - Cleaning
- .5 Section 01 78 00 - Closeout Submittals

1.2 SUMMARY

- .1 Section Includes:
 - .1 Electrical motors, drives and guards for mechanical equipment and systems.
 - .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 National Electrical Manufacturers Association (NEMA):
 - .1 ANSI/NEMA MG 1-2021, Motors and Generators
 - .2 NEMA MG 11-1977, Energy Management Guide for Selection and Use of Single-Phase Motors

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet including product characteristics, performance criteria, and limitations.
 - .2 Submit a complete list of HVAC motors and identify their locations before beginning installation of motors.
- .3 Shop Drawings: Submit drawings, stamped and signed by a professional engineer, indicating work of other Subcontractors, and identify areas that might have

congestion or conflicts.

.4 When requested, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

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

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

.2 Instructions: submit manufacturer's installation instructions.

.1 DCC Representative will make available 1 copy of systems supplier's installation instructions.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Submit maintenance data for motors, drives, and guards and incorporate into operation and maintenance manual.

1.6 MAINTENANCE MATERIALS SUBMITTALS

.1 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals, unless otherwise indicated in other Division 23 Sections.

1.7 QUALITY ASSURANCE

.1 Where multiple motors are required for the same application, provide the same manufacturer's motor model for all identical conditions.

.2 Health and Safety Requirements: Comply with Section 01 70 12 - Health and Safety Requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.3 Packaging Waste Management and Disposal: Perform Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

.1 Comply with Canada's Energy Efficiency Regulations.

2.2 GENERAL

- .1 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

2.3 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W or 1/2 HP: NEMA MG 11, speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W or 1/2 HP and larger: ANSI/NEMA MG 1, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 575 V, unless otherwise indicated.

2.4 TEMPORARY MOTORS

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by DCC Representative for temporary use. Work will only be accepted when specified motor is installed.

2.5 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 7.5 kW: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.6 DRIVE GUARDS

- .1 Provide guards for unprotected drives.

- .2 Guards for belt drives;
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install according to manufacturer's instructions and supplemented by the requirements of the Contract Documents.
- .2 Locate motors with adequate access space to allow safe and unimpeded maintenance services.
- .3 Install with minimum interference with other equipment and services.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Fasten motors and equipment securely in place.
- .6 Replace temporary motors with specified motors.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control..

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 74 11 – Cleaning
- .4 Section 07 84 00 - Fire Stopping

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .2 American Society of Mechanical Engineers (ASME)
 - .2 ASME B31.1, Power Piping.
- .3 National Fire Code of Canada (NFCC).

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, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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.
- .3 Packaging Waste Management: remove for reuse of pallets, crates and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal..

Part 2 PRODUCTS

2.1 MATERIAL

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
 - .1 Primers, Paints and Coating: in accordance with manufacturer's recommendations for surface conditions.
 - .2 Primer: maximum VOC limit 250 g/L to SCAQMD Rule 1113
 - .3 Paints: maximum VOC limit 150 g/L to SCAQMD Rule 1113.
- .2 Sealants: maximum VOC limit to SCAQMD Rule 1168
- .3 Adhesives: maximum VOC limit to SCAQMD Rule 1168
- .4 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

Part 3 EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

- .1 Install air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.

3.7 PIPEWORK INSTALLATION

- .1 Install pipework to ASME B31.1 and Manufacturer's Recommendations.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use gate, ball or butterfly valves at branch take-offs for isolating purposes except where specified.
 - .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
- .16 Check Valves:
 - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:

- .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws.
 - .1 Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant mechanical Sections.
- .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise DCC Representative 48 hours minimum prior to performance of pressure tests.

- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of DCC Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. DCC Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by DCC Representative.

3.13 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by DCC Representative.
- .2 Request written approval by DCC Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.14 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1, Power Piping.
 - .2 ASME B31.3, Process Piping.
 - .3 ASME Boiler and Pressure Vessel Code:
 - .1 BPVC Section I: Power Boilers.
 - .2 BPVC Section V: Nondestructive Examination.
 - .3 BPVC Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS B3.0-41, Welding Procedure and Performance Qualification.
 - .2 AWS C1.1M/C1.1, Recommended Practices for Resistance Welding.
 - .3 AWS WI, Welding Inspection Handbook.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code. Includes updates.
 - .4 CSA W117.2, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2, Certification of Welding Inspectors.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Welders:
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Submit welder's qualifications to DCC Representative.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

- .2 Inspectors:
 - .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
 - .1 Registration of welding procedures in accordance with CSA B51.
 - .2 Copy of welding procedures available for inspection.
 - .3 Safety in welding, cutting and allied processes in accordance with CSA W117.2.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of pallets crates padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal .

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 APPLICATION

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

3.2 QUALITY OF WORK

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

3.3 INSTALLATION REQUIREMENTS

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

- .2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS – GENERAL REQUIREMENTS

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

3.5 SPECIALIST EXAMINATIONS AND TESTS

- .1 General:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by DCC Representative.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test 10% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and spot gamma ray radiographic (hereinafter referred to as "radiography") tests.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by DCC Representative of total of up to 10% of welds, selected at random by DCC Representative by radiographic tests.
- .5 Spot radiography:
 - .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by DCC Representative from welds which would be most difficult to repair in event of failure after system is operational.
 - .2 Radiographic film:
 - .1 Identify each radiographic film with date, location, name of welder, and submit to DCC Representative. Replace film if rejected because of poor quality.
 - .3 Interpretation of radiographic films:
 - .1 By qualified radiographer.
 - .4 Failure of radiographic tests:
 - .1 Extend tests to welds by welder responsible when those welds fails tests.
- .6 Magnetic particle tests for 10% piping systems.

3.6 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.
- .2 In addition, chilled water systems below 500 kPa:
 - .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
 - .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
 - .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
 - .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
 - .5 Repair cracks and defects in excess of 0.8 mm in depth.
 - .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic tests.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

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

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal .

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 74 11 – Cleaning
- .4 Section 23 05 53 - Mechanical Identification

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B40.100, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self-Indicating, Commercial/Industrial Type.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test and Evaluation Reports:
 - .1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for 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 and with manufacturer's written instructions.
- .2 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Design point to be at mid-point of scale or range.
- .2 Ranges: as indicated.
- .3 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

2.2 DIRECT READING THERMOMETERS

- .1 Industrial, variable angle type, liquid filled and 125 mm scale length: to CAN/CGSB-14.4 or ASME B40.200.
 - .1 Resistance to shock and vibration.

2.3 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass.

2.4 PRESSURE GAUGES

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.
- .2 Provide:
 - .1 Snubber for pulsating operation.
 - .2 Diaphragm assembly for corrosive service.
 - .3 Gasketed pressure relief back with solid front.
 - .4 Bronze stop cock.
 - .5 Oil filled for high vibration applications.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Install thermometers and gauges so they can be easily read from floor or platform.
 - .1 If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

- .1 Install in wells on piping. Include heat conductive material inside well.
- .2 Install in locations as indicated and on inlet and outlet of:
 - .1 Domestic Hot Water Tanks.
- .3 Install wells as indicated only for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

- .1 Install in locations as follows:
 - .1 Suction and discharge of pumps.
 - .2 Upstream and downstream of PRV's.
 - .3 Upstream and downstream of control valves.
 - .4 Inlet and outlet of coils.
 - .5 Inlet and outlet of liquid side of heat exchangers.
 - .6 In other locations as indicated.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

- .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53 - Mechanical Identification, identifying medium.

3.6 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.

3.7 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 74 11 – Cleaning
- .4 Section 01 78 00 - Closeout Submittals

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
 - .1 ASTM A 276/A276M, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B 62, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B 283/B283M, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-80, Bronze Gate Globe, Angle and Check Valves.

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 for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 – Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials/Spare Parts:
 - .1 Furnish following spare parts:
 - .1 Valve seats: one for every 10 valves each size, minimum 1.

- .2 Discs: one for every 10 valves, each size. Minimum 1.
- .3 Stem packing: one for every 10 valves, each size. Minimum 1.
- .4 Valve handles: 2 of each size.
- .5 Gaskets for flanges: one for every 10 flanged joints.
- .2 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.
 - .2 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

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:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 Products to have CRN registration numbers.
- .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
 - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
- .3 Lockshield Keys:
 - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.
- .4 Gate Valves:
 - .1 Requirements common to gate valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Bonnet: union with hexagonal shoulders.
 - .3 Connections: screwed with hexagonal shoulders.
 - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
 - .5 Packing: non-asbestos.
 - .6 Handwheel: non-ferrous.

- .7 Handwheel Nut: bronze to ASTM B62.
 - .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
 - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
 - .2 Operator: Handwheel.
 - .3 NPS 2 and under, rising stem, split wedge disc, Class 125:
 - .1 Body: with long disc guides, screwed bonnet.
 - .2 Disc: split wedge, bronze to ASTM B 283, loosely secured to stem.
 - .3 Operator: Handwheel.
 - .4 Service: Domestic Water.
 - .4 NPS 2 and under, rising stem, solid wedge disc, Class 125:
 - .1 Body: with long disc guides, screwed bonnet.
 - .2 Operator: handwheel.
 - .3 Service: Domestic Water.
 - .5 Globe Valves:
 - .1 Requirements common to globe valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Bonnet: union with hexagonal shoulders.
 - .3 Connections: screwed with hexagonal shoulders.
 - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
 - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
 - .6 Handwheel: non-ferrous.
 - .7 Handwheel Nut: bronze to ASTM B 62.
 - .2 NPS 2 and under, composition disc, Class 125:
 - .1 Body and bonnet: screwed bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
 - .3 Operator: handwheel.
 - .4 Service: Domestic water.
 - .3 NPS 2 and under, plug disc, Class 150, screwed ends:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A 276, loosely secured to stem.
 - .3 Operator: handwheel.
 - .4 Service: Domestic water.
 - .4 Angle valve, NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
 - .3 Operator: handwheel.
 - .4 Service: Domestic water.
 - .6 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections:
 - .1 Screwed with hexagonal shoulders.
 - .2 Soldered connections permitted for domestic water only.
 - .2 NPS 2 and under, swing type, bronze disc, Class 125:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex

- head.
- .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
- .3 Service: Domestic water.
- .3 NPS 2 and under, swing type, bronze disc:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .3 Service: Domestic water.
- .4 NPS 2 and under, vertical lift type, bronze disc, Class 125:
 - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
 - .2 Service: Domestic water.
- .7 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.
 - .9 Service: Domestic water.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME):
 - .1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250.
 - .3 ANSI/ASME B16.25, Buttwelding Ends.
 - .4 ANSI/ASME B16.10, Face to Face and End to End Dimensions of Valves.
 - .5 ANSI/ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
- .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .2 ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B 209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry Inc. (MSS):
 - .1 MSS SP-78, Cast Iron Plug Valves, Flanged and Threaded Ends.

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for each valve and include product characteristics, performance criteria, physical size, finish and limitations. Closeout Submittals:
 - .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.

1.4 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
 - .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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect 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 as specified in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 MAINTENANCE

.1 Furnish following spare parts:

- .1 Stem packing: one for every 10 valves, each size, minimum 1.
- .2 Gaskets for flanges: one for every 10 flanged joints.

.2 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

Part 2 Products

2.1 MATERIAL

.1 Valves:

- .1 Except for specialty valves, to be of single manufacturer.
- .2 Products to have CRN registration number.

2.2 ECCENTRIC PLUG VALVES - SCREWED ENDS

.1 General:

- .1 Dead-tight shut-off on liquids and gases at pressure differentials up to 1.2 MPa in forward direction, 520 kPa in reverse direction.

.2 Up to NPS 2, screwed ends:

- .1 Body: cast iron to ASTM B 209 Class B.
- .2 Plug:
 - .1 NPS 1/2 and 3/4: bronze to ASTM B 62.
 - .2 NPS 1 to NPS 2: bronze to ASTM B 62.
- .3 Bearings: permanently lubricated, bronze to ASTM B 62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
 - .1 Plastic seat coating between plug and body.
 - .2 Resilient seal moulded into groove in plug face.

- .3 Seal materials: BUNA Stem seals with Neoprene plug seals.
- .4 Isobutene Isoprene stem seal with isobutene-isoprene plug seals.
- .5 End connections: screwed, roll grooved.
- .6 Operators: lever with adjustable memory stop.
- .7 Service: Natural gas.
- .3 NPS 2 1/2 to NPS 4, flanged ends:
 - .1 Body: cast iron to ASTM B 209 Class B.
 - .2 Plug: nickel-plated cast iron to ANSI.
 - .3 Bearings: permanently lubricated, bronze to ASTM B 62 in upper and lower journals.
 - .4 Seals: double-seal consisting of:
 - .1 Plastic seat coating between plug and body.
 - .2 Resilient seal moulded into groove in plug face.
 - .3 Seal materials: BUNA Stem seals with Neoprene plug seals.
 - .4 Isobutene Isoprene stem seal with isobutene-isoprene plug seals.
 - .5 End connections: flanged to ANSI B16.1.
 - .6 Operators: lever with adjustable memory stop.
 - .7 Service: Natural gas.

2.3 LUBRICATED PLUG VALVES

- .1 Principle of operation:
 - .1 Special sealing compound used to effect tight seal. When line pressure applied to valve in closed position, parallel plug forced against downstream side of valve. The metal-to-metal contact and sealing compound ensures leak-tight seal.
- .2 Testing to specifications: MSS SP-78 for non-shock pressure at specified temperature.
- .3 End connections:
 - .1 NPS ½ to 2: screwed ends.
 - .2 NPS 2½ to 12: flanged ends.
- .4 Valve:
 - .1 Body: cast iron to ASTM A 126 Class B semi-steel.
 - .2 Pressure rating: NPS ½ to 12:
 - .1 Screwed end valves: screwed to NPT standards.
 - .2 Flanged end valves: flanged to ANSI B16.1 Class 125. Flanged valves NPS 2-8 face dimensions in accordance with ANSI B16.10 short pattern, making them interchangeable with Class 125 flanged cast iron gate valves.
 - .3 Hydrostatic tests: body 300 psig. Seat: 100 psig.
 - .3 Plug: cylindrical or tapered, with regular pattern port - 90 degrees from full open to fully closed, complete with PTFE thrust ring: 100% full port.

- .4 Number of ports: as indicated.
- .5 Ends: with hexagon shoulders, ends screwed to ANSI B1.20.1, Flanged to ANSI B16.1, butt welding to ANSI B16.25, socket-welding to ANSI B16.11.
- .6 Lubrication system, nickel-plated.
- .7 Lubricant: to suit type, temperature and pressure of contained fluid.
- .8 Provide sealing compound injection gun designed for use with pre-packed sealing compound cartridges and valve fitted with button head nipples and combination sealing screws.
- .9 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film. Lubricant receptacle to hold additional lubricant. Lubricant screw for lubrication. Check valve to prevent reverse flow of lubricant. O-rings between body and plug.
- .5 Operator:
 - .1 Up to NPS 5: manual lever.
- .6 Accessories: lubricant gun.
- .7 Service: Natural gas.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION OF LUBRICATED PLUG VALVES

- .1 Install with line pressure acting to hold plug against body port which are to be cut-off from higher pressure.

3.3 COMMISSIONING OF LUBRICATED PLUG VALVES

- .1 Determine the type of sealing compound for particular application.
- .2 Open and close valve at least 3 times to ensure distribution of sealing compound evenly and to ensure tight shut-off.
- .3 When operating valve, ease valve off body to ensure that plug is free to float.

- .4 Determine frequency of re-lubrication during commissioning of remainder of system.

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 19 - 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 plug valve installation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 - Quality Control
- .3 Section 01 61 00 - Common Product Requirements
- .4 Section 01 74 11 – Cleaning
- .5 Section 01 78 00 - Closeout Submittals
- .6 Section 03 30 00 - Cast-in-Place Concrete
- .7 Section 05 12 23 - Structural Steel for Buildings

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1, Power Piping.
- .2 ASTM International
 - .1 ASTM A 125, Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 563, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58, Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation.

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 for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .5 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .6 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.
 - .1 DCC Representative will make available 1 copy of systems supplier's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58
- .2 Performance Requirements:
 - .1 Design supports, platforms, catwalks, hangers to withstand seismic events in accordance with the National Building Code 2020.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58 and ANSI B31.1.
- .2 Use components for intended design purpose only. Do not use for rigging or erection

purposes.

- .3 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP 58.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP 69.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS-SP 58.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
- .6 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel black galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS-SP 58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for riveting to insulation shields.

- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS-SP 58.
- .10 U-bolts: carbon steel to MSS-SP 58 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, epoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS-SP 69.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

2.5 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m² density insulation plus insulation protection shield to: MSS-SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .1 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69

2.6 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A 125, shot peened, magnetic particle inspected, with +/- 5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops.
- .4 Steel alloy springs: to ASTM A 125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.9 ROOF PIPE SUPPORTS

- .1 Piping on roof shall be supported by an engineered pre-fabricated pipe system specifically designed to be installed on the roof. The system shall consist of support assembly, and suitable pipe hangers and supports. The system shall be custom designed to fit the piping and conduits to be installed and the actual conditions of service.
- .2 Pipe supports; Base plate; minimum 250 mm x 400 mm x 75 mm polypropylene or rubber base with UV inhibitors, galvanized steel, pipe supports with threaded rod risers, 890 kg/m³ support capacity. Suitable to support gas, refrigeration piping systems, cable tray, electrical conduit.

2.10 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.11 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications,

including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Plumbing piping: to Canadian Plumbing Code.
- .2 Fire Protection: to applicable fire code.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.
- .4 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .5 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
Up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.3 m
5	4.3 m	-
6	4.3 m	-

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 70 12 - Safety Requirements
- .4 Section 01 74 11 - Cleaning
- .5 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.2 SUMMARY

- .1 Section Includes:
 - .1 Vibration isolation materials and components and their installation.

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Building Code of Canada (NBC).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Provide separate shop drawings for each isolated system, system shop drawings complete with performance and product data.
 - .3 Provide detailed drawings of seismic control measures for equipment and piping.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 DCC Representative will make available 1 copy of systems supplier's installation instructions.
 - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 – Health and Safety Requirements..

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation as indicated.
- .2 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

2.2 ELASTOMERIC PADS

- .1 Type EP1 - neoprene waffle or ribbed; 50 durometer; maximum loading 350 kPa.
- .2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for outdoor 100% relative humidity installations.
- .4 Colour code springs.

2.5 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
- .6 Performance: as indicated.

2.6 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.

- .6 Performance: as indicated.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.8 HORIZONTAL THRUST RESTRAINT

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
- .1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support.
 - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .5 Where isolation is bolted to floor use vibration isolation rubber washers.
- .6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and site visit upon completion of installation scheduled as follows:
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Twice during the installation, at 25% and 60% completion stages.
 - .4 Upon completion of installation.
 - .3 Submit manufacturer's reports to DCC Representative within 3 days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
 - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .2 Take vibration measurements for equipment as indicated listed below.
 - .1 Air Handling Units
 - .3 Provide DCC Representative with notice 24 h in advance of commencement of tests.
 - .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
 - .5 Submit complete report of test results including sound curves.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 70 12 - Safety Requirements
- .4 Section 01 74 11 - Cleaning
- .5 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.2 REFERENCES

- .1 CSA Group (CSA)
 - .1 CAN/CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2020 (NBC).

1.3 DEFINITIONS

- .1 Priority Two (P2) Buildings: buildings in which life safety is of paramount concern. It is not necessary that P2 buildings remain operative during or after earthquake activity.
- .2 SRS: acronym for Seismic Restraint System.

1.4 DESCRIPTION

- .1 SRS fully integrated into, and compatible with:
 - .1 Noise and vibration controls specified elsewhere.
 - .2 Structural, mechanical, electrical design of project.
- .2 Systems, equipment not required to be operational during and after seismic event.
- .3 During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position.
- .4 Designed by Professional Engineer specializing in design of SRS and registered in Province of Ontario.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .3 Submit design data including:

- .1 Full details of design criteria.
 - .2 Design calculations (including restraint loads resulting from seismic forces in accordance with National Building Code, detailed work sheets, tables).
 - .3 Separate shop drawings for each SRS and devices for each system, equipment.
 - .4 Identification of location of devices.
 - .5 Schedules of types of SRS equipment and devices.
 - .6 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
 - .7 Installation procedures and instructions.
 - .8 Design calculations including restraint loads to NBC and Supplement
 - .9 Detailed work sheets, tables.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 DCC Representative will make available 1 copy of systems supplier's installation instructions.
- .5 Closeout Submittals:
- .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 – Health and Safety Requirements..

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 SRS MANUFACTURER

- .1 SRS from one manufacturer regularly engaged in SRS production.

2.2 GENERAL

- .1 SRS to provide gentle and steady cushioning action and avoid high impact loads.
- .2 SRS to restrain seismic forces in every direction.
- .3 Fasteners and attachment points to resist same load as seismic restraints.
- .4 SRS of Piping systems compatible with:
 - .1 Expansion, anchoring and guiding requirements.
 - .2 Equipment vibration isolation and equipment SRS.
- .5 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.
- .6 Attachments to RC structure:
 - .1 Use high strength mechanical expansion anchors.
 - .2 Drilled or power driven anchors not permitted.
- .7 Wet pipe sprinkler systems: refer to Section 21 13 13 - Wet Pipe Sprinkler Systems.
- .8 Seismic control measures not to interfere with integrity of fire stopping.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

- .1 Floor-mounted equipment, systems:
 - .1 Anchor equipment to equipment supports.
 - .2 Anchor equipment supports to structure.
 - .3 Use size of bolts scheduled in approved shop drawings.
- .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Install tight to structure.
 - .2 Cross-brace in every direction.
 - .3 Brace back to structure.
 - .4 Slack cable restraint system.
 - .2 SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT

- .1 Floor mounted equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Vibration isolators with built-in snubbers.
 - .2 Vibration isolators and separate snubbers.
 - .3 Built-up snubber system approved by DCC Representative, consisting of structural elements and elastomeric layer.

- .2 SRS to resist complete isolator unloading.
- .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
- .4 Cushioning action: gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.
- .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Slack cable restraint system.
 - .2 Brace back to structure via vibration isolators and snubbers.

2.5 SLACK CABLE RESTRAINT SYSTEM (SCS)

- .1 Use elastomer materials or similar to avoid high impact loads and provide gentle and steady cushioning action.
- .2 SCS to prevent sway in horizontal plane, “rocking” in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Attachment points and fasteners:
 - .1 To withstand same maximum load that seismic restraint is to resist and in every direction.
- .2 Slack Cable Systems (SCS):
 - .1 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
 - .2 Use appropriate grommets, shackles, other hardware to ensure alignment of restraints and to avoid bending of cables at connection points.
 - .3 Piping systems: provide transverse SCS at 10 m spacing maximum, longitudinal SCS at 20 m maximum or as limited by anchor/slack cable performance.
 - .4 Small pipes may be rigidly secured to larger pipes for restraint purposes, but not reverse.

- .5 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), tie back to structure at maximum of 45 degrees to structure.
 - .6 Adjust restraint cables so that they are not visibly slack but permit vibration isolation system to function normally.
 - .7 Tighten cable to reduce slack to 40 mm under thumb pressure. Cable not to support weight during normal operation.
- .3 Install SRS at least 25 mm from equipment, systems, services.
- .4 Miscellaneous equipment not vibration-isolated:
- .1 Bolt through house-keeping pad to structure.
- .5 Co-ordinate connections with other disciplines.
- .6 Vertical tanks:
- .1 Anchor through house-keeping pad to structure.
 - .2 Provide steel bands above centre of gravity.
- .7 Horizontal tanks:
- .1 Provide at least two straps with anchor bolts fastened to structure.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
- .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and site visit upon completion of installation scheduled as follows:
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Twice during the installation, at 25% and 60% completion stages.
 - .4 Upon completion of installation.
 - .3 Submit manufacturer's reports to DCC Representative within 3 days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
- .1 SRS: inspected and certified by Seismic Engineer upon completion of installation.
 - .2 Provide written report to DCC Representative with certificate of compliance.
 - .3 Commissioning Documentation:
 - .1 Upon completion and acceptance of certification, hand over to DCC Representative complete set of construction documents, revised to show "as-built" conditions.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENT

- .1 Section 09 91 00 – Painting.

1.2 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, valves and controllers, including the installation and location of identification systems.

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-24.3, Identification of Piping Systems.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Product data to include paint colour chips, other products specified in this section.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with 01 70 12 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Dispose of unused material at official hazardous material collections site approved by DCC Representative.

- .3 Do not dispose of unused material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity date of manufacturer.
 - .2 Motor: horse power (H.P.) voltage, Hz, phase, power factor, duty, frame size.

2.2 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from DCC Representative.

2.3 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Natural gas: to CSA/CGA B149.1.
 - .2 Sprinklers: to NFPA 13.

2.4 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.

- .5 Extent of background colour marking:
- .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
- .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive plastic-coated cloth with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
- .1 Where not listed, obtain direction from DCC Representative.
 - .2 Colours for legends, arrows: to following table:

Background Colour:	Legend, Arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Natural gas	to Codes	
Fire protection water	Red	FIRE PROT. WTR

2.5 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.5 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.6 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.7 LANGUAGE

- .1 Identification in English and French.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

- .1 Provide identification only after painting specified Section 09 91 00 - Painting has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.

- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by DCC Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Testing, adjusting, and balancing of HVAC equipment to achieve specified performance requirements.
- .2 Testing, adjusting, and balancing shall be inclusive of all new and existing systems affected by the scope of work.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
- .2 Associated Air Balance Council (AABC):
 - .1 ANSI/AABC National Standards for Total System Balance, Seventh Edition, 2016
- .3 National Environmental Balancing Bureau (NEBB):
 - .1 NEBB Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems, Ninth Edition, 2019
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - .1 SMACNA 1780-2002 - HVAC Systems - Testing, Adjusting and Balancing

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Test and balance each system independently and where interlocked with other systems, in unison with those systems.
- .2 Scheduling:
 - .1 Schedule time required for work of this Section (including repairs, and re-testing) into Project schedules to ensure completion before scheduled completion date.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit proposed methodology and procedures for performing work of this Section.
- .2 Before starting work of this Section, submit names and documented qualifications of personnel to perform work of this Section.
- .3 Submit list of instruments and include serial numbers and calibration certificates.
- .4 Preliminary Report: Submit for checking and approval by DCC Representative before submission of formal report. Include:
 - .1 Details of instruments used
 - .2 Details of procedures employed
 - .3 Calculations procedures
 - .4 Summaries

- .5 Testing and Balancing Report:
 - .1 Format in accordance with ANSI/AABC National Standards for Total System Balance ANSI/ASHRAE 111 NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems SMACNA 1780 and show results in SI units.
- .6 Include:
 - .1 Project record drawings
 - .2 System schematics
 - .3 Submit six copies of the report to DCC Representative , in French and English , in D-ring binders, complete with index tabs.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Test and balance systems regulated by codes to the satisfaction of the authority having jurisdiction.
- .2 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .3 Duration: TAB duration shall occur for 40 hours minimum.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 PREPARATION

- .1 During construction, coordinate location and installation of measurement and balancing devices, equipment, accessories, measurement ports, and fittings.
- .2 Calibrate instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate instruments within three months of work. Submit certificate of calibration.
- .4 Notify DCC Representative seven days before start of work.

3.2 VERIFICATION OF CONDITIONS

- .1 Verify that building is substantially complete, including:
 - .1 Installation of ceilings, doors, windows, and other construction affecting the Work.
 - .2 Application of weatherstripping, sealing, and sealants.
 - .3 Pressure, leakage, and other tests specified elsewhere in Division 23.
 - .4 Provisions for Work are installed and operational.

- .2 Verify proper, normal, and safe operation of mechanical and associated electrical and control systems affecting Work including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place are clean.
 - .2 Duct systems are clean.
 - .3 Ducts, air shafts, and ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, and volume control dampers are installed and open.
 - .6 Coil fins are combed and clean.
 - .7 Access doors are installed and closed.
 - .8 Outlets are installed and volume control dampers are open.
 - .3 Liquid systems:
 - .1 Flushed, filled, and vented.
 - .2 Correct pump rotation.
 - .3 Strainers are in place and baskets are clean.
 - .4 Isolating and balancing valves are installed and open.
 - .5 Calibrated balancing valves are installed at factory settings.
 - .6 Chemical treatment systems are complete and operational.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 70 12 - Safety Requirements
- .4 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
 - .1 ANSI/SMACNA 016-2012, HVAC Air Duct Leakage Test Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

- 1. Sequencing:
 - .1 Test ducts before installation of insulation or other forms of concealment.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit details of test instruments to be used at least three months before anticipated start date.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
 - .1 Submit proposed report form and test report format to DCC Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from DCC Representative.
 - .2 Prepare report of results and submit to DCC Representative within 24 hours of completion of tests. Include:
 - .1 Schematic of entire system.
 - .2 Schematic of section under test showing test site.
 - .3 Required and achieved static pressures.
 - .4 Orifice differential pressure at test sites.
 - .5 Permissible and actual leakage flow rate (L/s) for test sites.

- .6 Witnessed certification of results.
- .3 Include test reports in final TAB report.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements

Part 2 Products

2.1 TEST INSTRUMENTS

- .1 Test apparatus to include:
 - .1 Fan capable of producing required static pressure.
 - .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
 - .3 Flow measuring instrument compatible with the orifice plate.
 - .4 Calibration curves for orifice plates used.
 - .5 Flexible duct for connecting to ductwork under test.
 - .6 Smoke bombs for visual inspections.
- .2 Test apparatus: accurate to within +/- 3% of flow rate and pressure.
- .3 Submit details of test instruments to be used to DCC Representative at least three months before anticipated start date.
- .4 Test instruments: calibrated and certificate of calibration deposited with DCC Representative no more than 28 days before start of tests.
- .5 Re-calibrated every six months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

- .1 Equipment and system components such as constant volume duct leakage: 2%.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .2 Leakage tests on following systems not to exceed specified leakage rates.
 - .1 Small duct systems up to 250 Pa: Leakage 2%.
 - .2 Large low pressure duct systems up to 500 Pa: leakage 2%.
 - .3 HP duct systems up to 2500 Pa pressure classification: leakage 1%.
- .3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.3 TESTING

- .1 Test when ambient temperature will not affect effectiveness of seals and gaskets.
- .2 Test lengths of ducts consistent with test equipment capacity.
- .3 Test fittings, branch ducts, tap-ins.
- .4 Tested systems shall include;
 - .1 Paint Booth supply and exhaust ductwork, booth to fan connection.
 - .2 All new and existing supply, return, and exhaust air distribution affected by the scope of work.
 - .3 Where existing distribution is to be tested;
 - .1 Provide temporary capped connections at all grille locations.
 - .2 Provide temporary capped connection at connections to equipment.
 - .3 Reinstate duct distribution to new condition after final acceptance of duct pressure test.
 - .4 Minimum three (3) selected locations; New air ducts exceeding 15m.
- .5 Repair leaks and repeat tests until specified pressures are attained.
- .6 Base partial system leakage calculations on ANSI/SMACNA 016.
- .7 Seal leaks that can be heard or felt, regardless of their contribution to total leakage. Retest after seals have cured.

3.4 FIELD QUALITY CONTROL

- .1 Performance Verification:
 - .1 DCC Representative to witness tests and to verify reported results.
 - .2 To be certified by same TAB agency approved by DCC Representative to undertake TAB on this project.

- .3 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Thermal insulation for ductwork and ductwork accessories.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

- .1 ANSI/ASHRAE/IES 90.1-2022, Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 ASTM International (ASTM):

- .1 ASTM C335/C335M-17, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
- .2 ASTM C449-07, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- .3 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
- .4 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- .5 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
- .6 ASTM C1423-21, Standard Guide for Selecting Jacketing Materials for Thermal Insulation
- .7 ASTM C1729-21, Standard Specification for Aluminum Jacketing for Insulation

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

- .1 SCAQMD Rule 1168-17, Adhesive and Sealant Applications

.4 Midwest Insulation Contractors Association (MICA):

- .1 National Commercial and Industrial Insulation Standards Manual

.5 ULC Standards (ULC):

- .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.3 DEFINITIONS

.1 For purposes of this Section:

- .1 "Concealed" – means insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "Exposed" – means "not concealed" as previously defined.
- .3 "Insulation systems" – means insulation material, fasteners, jackets, and other accessories.

- .4 “Jacketing” – synonymous with cladding and lagging.

1.4 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 43 – Environmental Procedures
- .3 Section 01 61 00 - Common Product Requirements
- .4 Section 01 74 11 – Cleaning
- .5 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer’s product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Shop Drawings: Submit drawings.
- .4 Samples:
 - .1 When requested, submit for approval: Complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
 - .2 Mount sample on 12-mm plywood board.
 - .3 Affix typewritten label beneath sample indicating service.
- .5 Manufacturers’ Instructions:
 - .1 Submit manufacturers’ duct insulation jointing recommendations and special handling criteria, installation sequence, and cleaning procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer’s name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.
- .4 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SUSTAINABILITY CHARACTERISTICS

- .1 Adhesives and Sealants: Maximum VOC limit to SCAQMD Rule 1168
- .2 Provide certified products.

2.2 INSULATION

- .1 Mineral Fibre: Glass fibre, rock wool, or slag wool.
- .2 Fire/Smoke Rating: To CAN/ULC-S102.
 - .1 Maximum flame-spread rating: 25.
 - .2 Maximum smoke developed classification: 50.
- .3 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.
- .4 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket.
- .5 Type C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket.
 - .1 Maximum "k" factor: To ASTM C553.

2.3 JACKETS

- .1 Canvas jacketing: 220 g/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921
- .2 Lagging adhesive: Compatible with insulation
- .3 Aluminum jacketing: To ASTM C1729, with moisture barrier as scheduled.
 - .1 Thickness: 0.50 mm sheet.
 - .2 Finish: Smooth .
 - .3 Jacket banding and mechanical seals: 19-mm-wide, 0.5-mm-thick stainless steel.

2.4 ACCESSORIES

- .1 Vapour Retarder Lap Adhesive: Water based, fire retardant type, and compatible with insulation
- .2 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: Hydraulic setting on mineral wool, to ASTM C449.
- .4 Outdoor Vapour Retarder Finishes:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing Fabric: Fibrous glass, untreated 305 g/m².
- .5 Tape: Self-adhesive, aluminum, reinforced , 75-mm-wide minimum.
- .6 Contact Adhesive: Quick-setting
- .7 Canvas Adhesive: Washable.
- .8 Tie wire: 1.5-mm stainless steel.
- .9 Banding: 19-mm-wide, 0.5-mm-thick stainless steel.
- .10 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation.
- .11 Fasteners: 4 -mm-diameter pins with 35-mm- diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that pressure testing of ductwork systems is complete, witnessed, and certified.
- .2 Verify that surfaces are clean, dry, and free from foreign material.

3.2 INSTALLATION

- .1 Install to manufacturer's instructions, and in accordance with MICA National Commercial and Industrial Insulation Standards Manual.
- .2 Apply materials in accordance with manufacturer's instructions.
- .3 Use two layers of insulation with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes. Duct insulation shall be continuous through wall and ceiling openings and sleeves, except where firestopping is required.
 - .1 Ensure hangers and supports are outside vapour retarder jacket and in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .5 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: Install at 300-mm on centre in horizontal and vertical directions, minimum two rows each side.
- .7 At chilled ductwork, secure with banding. Fasteners penetrating puncturing the underlying vapour barrier are not acceptable.

3.3 SITE QUALITY CONTROL

- .1 Non-Conforming Work:
 - .1 Replace insulation with vapour barrier damage and moisture-saturated insulation

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation Types and Thicknesses: Conform to following table:

	Type	Vapour Retarder	Thickness (mm)
Rectangular warm air ducts	C-1	No	25
Supply, return, and exhaust ducts exposed in space being served			None
Outside air ducts to mixing plenum	C-1	Yes	25
Exhaust duct between dampers and louvres	C-1	No	25
Rectangular ducts outside	C-1	Special	50
Acoustically lined ducts	None		

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use Type C-1 insulation, scored to suit diameter of duct

.3 Exposed Insulation Finishes:

	MICA Manual Rectangular	MICA Manual Round
Indoor, concealed	None	None
Indoor, exposed within mechanical room	CRF/1	CRD/2
Outdoor, exposed to precipitation	CRF/3	CRD/4

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Thermal insulation for piping and piping accessories.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

- .1 ANSI/ASHRAE/IES 90.1-2022, Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 ASTM International (ASTM):

- .1 ASTM C335/C335M-17, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
- .2 ASTM C411-19, Standard Specification for Hot-Surface Performance of High-Temperature Thermal Insulation
- .3 ASTM C449/C449M-07, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- .4 ASTM C533-17, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- .5 ASTM C547-22, Standard Specification for Mineral Fiber Pipe Insulation
- .6 ASTM C1136-21, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

.3 Green Seal Environmental Standards (GS):

- .1 GS-36-13, Adhesives for Commercial Use

.4 Midwest Insulation Contractors Association (MICA):

- .1 North American Commercial and Industrial Insulation Standards Manual

.5 ULC Standards (ULC):

- .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .2 CAN/ULC-S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

1.3 DEFINITIONS

.1 For purposes of this section:

- .1 Concealed means insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 Exposed means not concealed as specified.
- .3 Jacketing is synonymous with cladding and lagging.

1.4 RELATED REQUIREMENTS

- .1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's product literature, specifications, and datasheets. Include product characteristics, performance criteria, and limitations.
 - .2 Submit WHMIS Safety Data Sheet (SDS).
- .3 Shop Drawings:
 - .1 Submit drawings indicating a list of insulation for each service location, insulation type, thickness, and jacketing type.
- .4 Samples:
 - .1 When requested submit for approval a complete assembly of each type of insulation system, coating, and adhesive proposed. Mount sample on 12-mm plywood board. Affix label beneath sample indicating service.
- .5 Quality assurance submittals:
 - .1 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: Submit manufacturer's installation instructions

1.6 QUALITY ASSURANCE

- .1 Health and Safety: Comply with Section 01 70 12 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Perform in accordance with Section Section 01 61 00 - Common Product Requirements.
- .2 Protect insulation from moisture.
- .3 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE CRITERIA

- .1 Provide Ecologo or GreenSeal certified products.
- .2 Fire and Smoke Rating: In accordance with CAN/ULC-S102.
 - .1 Maximum flame-spread rating: 25.
 - .2 Maximum smoke-developed classification: 50..

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, or slag wool.

- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.
- .3 Type A-1: Rigid moulded mineral fibre without factory-applied vapour retarder jacketing.
 - .1 Mineral fibre: To ASTM C547.
 - .2 Maximum "k" factor: To CAN/ULC-S702.1.
- .4 Type C-2: Mineral fibre blanket faced with factory-applied vapour retarder jacketing.
 - .1 Mineral fibre: To ASTM C533.
 - .2 Jacketing: To ASTM C1136.
 - .3 Maximum "k" factor: To ASTM C547.

2.3 JACKETING

- .1 Canvas jacketing: 220 g/m² cotton, plain weave, and treated with dilute fire retardant.
 - .1 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

- .1 Weatherproof caulking for jackets installed outdoors: To Section 07 92 00 - Joint Sealants.
- .2 Tape: Self-adhesive, aluminum, plain, minimum 50 mm wide
- .3 Contact adhesive: Quick setting.
- .4 Canvas adhesive: Washable.
- .5 Tie wire: 1.5-mm diameter stainless steel.
- .6 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.
- .7 Thermal insulating and finishing cement: Air drying on mineral wool, to ASTM C449.
- .8 Vapour retarder lap adhesive: Water-based and fire retardant type, compatible with insulation.
- .9 Indoor vapour retarder finish: Vinyl emulsion type acrylic, compatible with insulation.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that pressure testing of piping systems and adjacent equipment is complete, witnessed, and certified.
- .2 Verify that surfaces are clean, dry, and free from foreign material.

3.2 INSTALLATION

- .1 Install to manufacturer's instructions, and in accordance with MICA North American Commercial and Industrial Insulation Standards Manual.

- .2 Use two layers insulation with staggered joints when required nominal wall thickness exceeds 75 mm.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .4 Duct insulation shall be continuous through wall and ceiling openings and sleeves, except where firestopping is required.
- .5 Supports and hangers:
 - .1 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .2 Install hangars and supports outside vapour retarder jacket.
 - .3 Apply high compressive strength insulation that is suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.
- .2 Type: A-1.
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: Lap seal adhesive, lagging adhesive.
 - .3 Installation: Refer to MICA manual.
- .3 Type: C-2.
 - .1 With vapour retarder jacketing.
 - .2 Insulation securements: Tape at 300 mm on centre
 - .3 Seals: Lap seal adhesive, lagging adhesive.
 - .4 Installation: Refer to MICA manual.
- .4 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
 - .3 Insulation thickness (mm):
 - .4 Insulation Thicknesses

Application	Temp °C	Type						
Pipe sizes (NPS)			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Steam	up to 175	A-1	38	50	65	75	90	90
Condensate Return	60 - 94	A-1	25	38	38	38	38	38
Hot Water Heating	60 - 94	A-1	25	38	38	38	38	38
Domestic HWS, HWR		A-1	25	25	25	38	38	38

Application	Temp °C	Type						
Pipe sizes (NPS)			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic CWS with vapour retarder		C-2	25	25	25	25	25	25

- .5 Finishes:
- .1 Exposed indoors: Canvas jacketing .
 - .2 Exposed in mechanical rooms: Canvas jacketing .
 - .3 Concealed, indoors: Canvas on valves, fittings. No further finish.
 - .4 .7 Installation: To appropriate MICA manual recommendations.

3.4 SITE QUALITY CONTROL

- .1 Non-Conforming Work:
- .1 Replace insulation where there is damage to the vapour barrier and insulation is saturated with moisture.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 43 – Environmental Procedures
- .3 Section 01 70 12 - Safety Requirements
- .4 Section 01 78 00 - Closeout Submittals

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
 - .1 CSA B149.1, Natural Gas and Propane Installation Code, Includes updates.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meeting:

- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.

Part 2 Products

2.1 PIPE ABOVE GROUND

- .1 CSA approved flexible fitting for use as final connection to equipment.
- .2 Schedule 40 steel.

2.2 JOINTING MATERIALS

- .1 Screwed fittings: pulverized lead paste. Permitted in mechanical rooms only on piping NPS 1-1/2 and smaller. No screwed piping permitted outside of mechanical rooms.
- .2 Welded fittings: In accordance with CSA B149.1, latest edition.
- .3 Brazing: to ASTM B837.

2.3 FITTINGS

- .1 Steel pipe fittings, screwed, welded:
 - .1 Malleable iron: screwed, banded, Class 150.
 - .2 Welding: butt-welding fittings.
 - .3 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
 - .4 Bolts and nuts: to ASME B18.2.1.
 - .5 Nipples: schedule 40, to ASTM A53/A53M.

2.4 VALVES

- .1 National Code approved, lubricated plug type.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.
- .2 Install drip points:
 - .1 At low points in piping system.
 - .2 At connections to equipment.
- .3 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

3.2 VALVES

- .1 Install valves with stems upright or horizontal unless otherwise approved by DCC Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CSA B149.1 and requirements of Authorities Having Jurisdiction.
- .2 Application tolerances:
 - .1 +/- 2%.
- .3 PV procedures:
 - .1 Test performance of components.

3.4 ADJUSTING

- .1 Purging: purge after pressure test in accordance with CSA B149.1.
- .2 Pre-Start-Up Inspections:
 - .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
 - .2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.5 CLEANING

- .1 Cleaning: in accordance with CSA B149.1, supplemented as specified.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 74 11 – Cleaning
- .4 Section 07 84 00 - Fire Stopping
- .5 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
 - .1 ASTM A 480/A 480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A 635/A 635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
 - .3 ASTM A 653/A 653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts 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 Ontario, Canada.
- .4 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

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 dry location and 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 of pallets, crates, padding, and packaging materials as specified in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure PA	SMACNA Seal Class
125	C

- .2 Seal classification:
 - .1 Class C: transverse joints and connections made air tight with sealant, tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

- .1 Sustainability Characteristics:
 - .1 Adhesives and sealants: to SCAQMD Rule 1168 .
 - .2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius centreline radius: 1.5 times width of duct .
 - .2 Round: smooth radius five piece, centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
 - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 Short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Coordinate with 07 84 00 - Fire Stopping to ensure fire stopping material and installation does not distort duct.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

2.8 SATIN COAT STEEL

- .1 Lock forming quality: to ASTM A 653/A 653M, ZF75 zinc coating.

- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.
- .4 Application:
 - .1 All areas where new exposed ductwork installed, to be field painted.

2.9 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500.
 - .2 Hanger configuration: to SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA and following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
Up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50x50x6	10

- .4 Upper hanger attachments:
 - .1 For steel joist: manufactured joist clamp.
 - .2 For steel beams: manufactured beam clamps:

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 GENERAL

- .1 Do work in accordance with SMACNA as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
- .6 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

3.3 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA and as follows:

Duct Size (mm)	Spacing (mm)
To 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

- .1 Apply sealant in accordance with to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

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 and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation of high-pressure metallic ductwork, joints and accessories.
- .2 Related Sections:
 - .1 Section 01 33 00 – Submittal Procedures
 - .2 Section 01 70 12 – Safety Requirements
 - .3 Section 01 35 43 – Environmental Procedures
 - .4 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards – Metal and Flexible.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1st Edition.
 - .3 IAQ Guideline for Occupied Buildings Under Construction.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS – Material Safety Data for the following:
 - .1 Sealants.
 - .2 Tape.
 - .3 Proprietary Joints.
 - .4 Fittings.
- .3 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 QUALITY ASSURANCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 – Safety Requirements.
- .3 Indoor Air Quality (IAQ) Management Plan.
 - .1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect 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 as specified in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 DUCTWORK

- .1 Material:
 - .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A 653/A 653M.
 - .2 Thickness: to SMACNA.
- .2 Construction - round and oval
 - .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
 - .2 Transverse joints up to 900 mm: slip type with tape and sealants.
 - .3 Transverse joints over 900 mm: Vanstone.
 - .4 Fittings:
 - .1 Elbows: smooth radius, five-piece (for 90 degrees) three-piece (for 45 degrees). Centreline radius: 1.5 x diameter.

- .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.

2.2 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
2500	A
1500	A
1000	A
750	B

- .2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.

2.3 SEALANT

- .1 Sealant: oil resistant, water borne, polymer type flame resistant high velocity duct sealing compound. Maximum VOC content: 250 g/L (less water).

2.4 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.5 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of the same material as duct but next sheet metal thickness heavier than duct.
- .1 Maximum size duct supported by strap hanger: 500.
- .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA and following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:

- .1 For concrete: manufactured concrete inserts.
- .2 For steel joist: manufactured joist clamp or steel plate washer.

- .3 For steel beams: manufactured beam clamps.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of DCC Representative.
- .2 Inform DCC Representative 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 DCC Representative.

3.2 GENERAL

- .1 Do work in accordance with ASHRAE and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Insulate band hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.
- .4 Support risers in accordance with ASHRAE and SMACNA.
- .5 Install breakaway joints in ductwork on sides of fire separation. Ensure installation of firestopping does not distort duct.
- .6 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

3.3 HANGERS

- .1 Band hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA and as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.5 LEAKAGE TESTS

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

- .2 Do leakage tests in sections.
- .3 Perform trial leakage tests as instructed to demonstrate workmanship.
- .4 Do not install additional ductwork until trial test has been passed.
- .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows, or, as directed by DCC Representative.
- .6 Complete test before performance insulation or concealment Work.
- .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.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.
- .2 Related Sections:
 - .1 Section 22 05 00 – Common Work Results for Mechanical.
 - .2 Section 23 31 13.01 – Metal Ducts - Low Pressure to 500 Pa.
 - .3 Section 23 31 13.02 – Metal Ducts - High Pressure to 2500 Pa.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Coordinate submittal requirements and provide submittals.
- .3 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.
 - .2 Submit WHMIS MSDS. Indicate VOC's for adhesive and solvents during application and curing.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 – Safety Requirements.
- .2 Construction requirements: in accordance with DCC Representative's requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
 - .4 Divert unused metal materials from landfill to metal recycling facility as approved by DCC Representative.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 1.0 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m2.

2.3 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
 - .2 301 to 450 mm: four sash locks complete with safety chain.
 - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .5 Hold open devices.

2.4 TURNING VANES

- .1 Factory or shop fabricated double thickness without trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
 - .1 Size:
 - .1 600 x 1500 mm for person size entry.
 - .2 450 x 750 mm for servicing entry.
 - .3 As indicated.
 - .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 Elsewhere as indicated.

- .3 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Install insulation port extensions as required.
 - .4 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by DCC Representative.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .4 Turning vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with DCC Representative's requirements, include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Certified Wood.
 - .8 Low-emitting materials.

3.4 CLEANING

- .1 Perform cleaning operations as specified in Section Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIRMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 70 12 - Safety Requirements
- .4 Section 01 74 11 - Cleaning

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA):
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate the following:
 - .1 Frame and blade material.
 - .2 Bearings.
 - .3 Adjustment quadrant.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect 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 as specified in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.
- .2 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

2.2 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

- .3 Maximum blade height: 150 mm.
- .4 Bearings: pin in bronze bushings.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Maximum leakage : 21 L/S/m² at 1000 Pa.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.
- .7 Corrections and adjustments conducted by DCC Representative.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Related Sections:
 - .1 Section 22 05 00 – Common Work Results for Mechanical.
 - .2 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.
 - .3 Section 23 31 13.02 – Metal Ducts – High Pressure to 2500 Pa.
 - .4 Section 23 33 00 – Air Duct Accessories.
 - .5 Section 25 30 02 –Field Control Devices.

1.2 COMMISSIONING AND TESTING

- .1 Refer to the following sections for commissioning and testing requirements:
 - .1 Section 01 91 00 – Commissioning.
- .2 In accordance to the Preliminary Commissioning Plan.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Indicate the following:
 - .1 Performance data.
 - .2 Leakage test data pressure drop at listed airflow.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 DCC Representative will make available 1 copy of systems supplier's installation instructions.
- .3 Closeout Submittals
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 70 12 – Safety Requirements.
- .2 Certificates:
 - .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal

Part 2 Products

2.1 MULTI-LEAF DAMPERS

- .1 Opposed and / or parallel blade type as indicated.
- .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: to Section 25 30 02 – Field Control Devices.
- .6 Performance:
 - .1 Leakage: in closed position less than 2% of rated air flow at 500 Pa differential across damper.
- .7 Insulated aluminum dampers:
 - .1 Frames: insulated with extruded polystyrene foam with RSI 0.38.
 - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.38.
- .8 Acceptable Manufacturer's;
 - .1 Tamco, 9000
 - .2 Ruskin, CD40X2
 - .3 Nailor, 2020I Series

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant to maximum VOC 250 g/L.
- .4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with DCC Representative's requirements, include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Low-emitting materials.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS:

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 – Common Product Requirements.
- .3 Section 01 70 12 – Safety Requirements
- .4 Section 01 74 11 – Cleaning
- .5 Section 01 78 00 – Closeout Submittals
- .6 Section 23 33 00 – Air Duct Accessories

1.2 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 80: Standard for Fire Doors and Other Opening Protectives.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.
 - .2 ULC-S505, Fusible Links for Fire Protection Service.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Operators.
 - .3 Fusible links.
 - .4 Design details of break-away joints.
 - .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 DCC Representative will make available 1 copy of systems supplier's installation instructions.
 - .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
-

1.4 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 70 12 – Safety Requirements.
- .2 Certificates:
 - .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
 - .2 Provide following:
 - .1 6 fusible links of each type.
- .2 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
 - .2 Storage and Handling Requirements:
 - .1 Store materials indoors, in a clean and dry location and in accordance with manufacturer's recommendations.
 - .2 Store and protect fire and smoke dampers from damage and distortion.
 - .3 Handle dampers using the frame or sleeve. Do not lift or move dampers by the blades, actuator, or jackshaft.

Part 2 Products

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type B and C, listed and bear label of ULC, meet requirements of CFFM and NFPA 90A. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
 - .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.
 - .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
- .3 Top hinged: offset, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA fire smoke and radiation damper installation guide for HVAC systems and in manufacturer's instructions for fire dampers shall be followed.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with NFPA 80, NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.
- .5 Coordinate with installer of firestopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.
- .8 Provide complete listing of all installed fire dampers identifying:
 - .1 Sequential numbering identifier.
 - .2 Damper location.
 - .3 Damper size.
 - .4 Damper type.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete.
- .2 Section 23 85 01 – Variable Frequency Drives.
- .3 Section 23 33 00 – Air Duct Accessories.
- .4 Section 23 05 48 – Vibration Controls for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Air Conditioning and Mechanical Contractors (AMCA)
 - .1 ANSI/AMCA Standard 99, Standards Handbook.
 - .2 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 ANSI/AMCA 300, Reverberant Room Method for Sound Testing of Fans.
 - .4 ANSI/AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials
 - .2 NFPA 30, Flammable and Combustible Liquids Code
 - .3 NFPA 86, Standard for Ovens and Furnaces
 - .4 NFPA 90a, Installation of Air Condition and Ventilating Systems
 - .5 NFPA 90b, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
 - .6 NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids
- .5 National Fire Code of Canada (NFC)
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

- .2 Capacity: flow rate, static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Provide:
 - .1 Fan performance curves showing point of operation, BHP kW and efficiency.
 - .2 Sound rating data at point of operation.
- .4 Indicate:
 - .1 Motors, sheaves, bearings, shaft details.
 - .2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .6 DCC Representative will make available 1 copy of systems supplier's installation instructions.
- .7 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 70 12 – Safety Requirements.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
 - .1 Spare parts to include:
 - .1 Matched sets of belts.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
 - .1 Bearings and seals.
 - .2 Addresses of suppliers.
 - .3 List of specialized tools necessary for adjusting, repairing or replacing.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 FANS GENERAL

- .1 Motors:
 - .1 In accordance with Section 23 05 13 – Common Motors Requirements for HVAC Equipment supplemented as specified herein.
 - .2 For use with variable speed controllers.
 - .3 Sizes as indicated.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable motor bases, belt guards, coupling guards fan inlet safety screens as indicated and as specified in Section 23 05 13 – Common Motor Requirements for HVAC Equipment.
- .3 Provide explosion-proof fans in accordance with mechanical drawing schedule.
- .4 Factory primed before assembly in colour standard to manufacturer.

- .5 Scroll casing drains: as indicated.
- .6 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .7 Vibration isolation: to Section 23 05 48 – Vibration Controls for HVAC Piping and Equipment.
- .8 Flexible connections: to Section 23 33 00 – Air Duct Accessories.

2.2 MIXED FLOW, ROOF MOUNTED (EF-13)

- .1 General:
 - .1 Fans shall be constructed of low carbon steel and painted with an approved coating.
 - .2 Fan shall be cUL listed for UL705.
- .2 Performance:
 - .1 Fan air performance shall be based on tests conducted in accordance with AMCA Standard 210. Fans shall be non-overloading and shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the efficiency peak to assure quiet and stable operation under all conditions. Horsepower characteristics shall be self-limiting and shall reach a peak in the normal selection area.
- .3 Wheels:
 - .1 Wheels shall be in accordance with the standard sizes adopted by AMCA for tubular fans. Wheels shall be the high efficient, non-overloading, airfoil type. Airfoil blades shall be die-formed, double surface type blades continuously welded to a hub plate and wheel cone. All fans shall have tapered, smooth flowing, wheel cones. Industrial alkyd enamel finish.
- .4 Shafts:
 - .1 Shafts shall be 316SS. The shaft's first critical speed shall be at least 142% of the fan's maximum operating speed. This critical speed will refer to the top of the speed range for the fan's AMCA class.
- .5 Motor:
 - .1 Motor shall be Premium Efficiency 1800rpm – 4 pole. Enclosure shall be Explosion Proof.
- .6 Bearings:
 - .1 Bearings shall be designed for heavy-duty service with a minimum L10 life of 40,000 hours for Class I fans and 120,000 hours for Class II fans. Bearings shall be heavy-duty, self-aligning pillow block type. Pillow block bearings shall be either single row ball or double row spherical roller type. Fans shall be equipped with grease lines extending from the bearings to a point on the fan exterior.
- .7 Accessories:
 - .1 AMCA Classification: B - "B" ALWL/PLT.
 - .2 Access Door: S - Standard.
 - .3 Belt Guard: Y – Yes.

- .4 Disconnect Switch: G - Loose, Nema 7.
- .5 Drive Kit: VFD.
- .6 Companion Flange: U – Outlet.
- .7 Isolator: S - Spring (unhoused).
- .8 Acceptable Manufacturer's;
 - .1 PennBarry
 - .2 Greenheck
 - .3 Twin City

2.3 TUBE AXIAL, ROOF MOUNTED (EF-14)

- .1 General:
 - .1 Fan housing shall be constructed of continuously welded steel.
 - .2 Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
 - .3 Belts, bearings and drives shall be protected from the airstream with bearing covers.
- .2 Performance:
 - .1 Fan air performance shall be based on tests conducted in accordance with AMCA Standard 210. Fans shall be non-overloading and shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the efficiency peak to assure quiet and stable operation under all conditions. Horsepower characteristics shall be self-limiting and shall reach a peak in the normal selection area.
- .3 Wheels:
 - .1 The fan propeller shall be heavy duty, cast aluminum with high performance, tapered airfoil blades designed to meet varied capacity and pressure requirements.
 - .2 A standard square key or tapered bushing shall lock to propeller to the fan shaft. Hubs shall be two piece aluminum castings that securely lock the blades in place.
 - .3 Wheels shall be statically and dynamically balanced.
 - .4 The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.
- .4 Shafts:
 - .1 Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
- .5 Motor:
 - .1 Motor shall be Premium Efficiency 1800rpm – 4 pole. Enclosure shall be Explosion Proof.
 - .2 Motors to be NEMA T-frame, 1800 or 3600 RPM, Totally Enclosed Fan Cooled (TEFC), Explosion Proof (EXP) with a 1.15 service factor.
 - .3 Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service.
- .6 Bearings:

- .1 Bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type.
- .2 Bearings shall be 100% tested for noise and vibration by the manufacturer.
- .3 Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed for each pressure class. Average Life or (L-50) of 200,000 hours for vertical mount.
- .4 Fans shall be equipped with grease lines extending from the bearings to a point on the fan exterior.
- .7 Variable volume control devices:
 - .1 Variable Speed Drives: refer to Section 23 85 01 – Variable Frequency Drives.
- .8 Accessories:
 - .1 AMCA Classification: B - "B" ALWL/PLT.
 - .2 Shaft Seal: Teflon
 - .3 Access Door: S - Standard.
 - .4 Belt Guard: Y – Yes.
 - .5 Disconnect Switch: G – Mounted and wired, Nema 3R.
 - .6 Drive Kit: Adjustable.
- .9 Acceptable Manufacturer's;
 - .1 PennBarry
 - .2 Greenheck
 - .3 Twin City

2.4 ROOF-MOUNTED GENERAL EXHAUST FAN (EF-1, EF-10, EF-15)

- .1 Up-blast, belt drive, roof mounted exhaust fans, licensed to bear the AMCA Seal. Fans shall be cUL listed.
- .2 Motors: premium efficiency, motor enclosure requirement to match drawing schedule.
- .3 Forced motor cooling:
 - .1 Motors and drive components shall be located out of the airstream in a separate compartment.
- .4 Internal Bracing:
 - .1 Supports designed to transfer the weight of the motor mounting platform directly to the curb mounting surface.
 - .2 Solid steel shafts shall be precision ground and polished.
- .5 Self-Aligning Bearings
 - .1 Heavy-duty bearings are sized for a minimum L50 life in excess of 200,000 hours of operation.
 - .2 Drives and Belts Pulleys are pre-set to the specified RPM. Cast iron variable pitch pulleys shall be adjustable, allowing for field balancing based on actual field conditions. All pulleys shall be sized for at least 150% of the driven horsepower.
- .6 Wheels

- .1 Highly-tooled venturis backward inclined and non-overloading centrifugal wheels, constructed of aluminum alloys.
- .7 Accessories:
 - .1 AMCA Classification: C - "C" AL LN/PL.
 - .2 Hinged sub-base.
 - .3 450 mm (18") high prefabricated heavy-gauge steel roof curbs.
 - .4 Gravity Operated Back Draft Damper.
 - .5 Disconnect Switch: 3R - Nema 3R.
- .8 Acceptable Manufacturer's;
 - .1 PennBarry
 - .2 Greenheck
 - .3 Twin City

2.5 WALL-MOUNTED GENERAL EXHAUST FAN (EF-11)

- .1 Belt drive, spark resistant construction AMCA 'B' construction wall mounted exhaust fans, licensed to bear the AMCA Seal. Fans shall be cUL listed.
- .2 Motors: premium efficiency, explosion proof motor enclosure to match drawing schedule.
- .3 Motors and drive components shall be located out of the airstream in a separate compartment.
- .4 Internal Bracing:
 - .1 Supports designed to transfer the weight of the motor mounting platform directly to the curb mounting surface.
 - .2 Solid steel shafts shall be precision ground and polished.
- .5 Self-Aligning Bearings
 - .1 Heavy-duty bearings are sized for a minimum L50 life in excess of 200,000 hours of operation.
 - .2 Drives and Belts Pulleys are pre-set to the specified RPM. Cast iron variable pitch pulleys shall be adjustable, allowing for field balancing based on actual field conditions. All pulleys shall be sized for at least 150% of the driven horsepower.
- .6 Wheels
 - .1 Highly-tooled venturis backward inclined and non-overloading centrifugal wheels, constructed of aluminum alloys.
- .7 Accessories:
 - .1 Gravity Operated Back Draft Damper.
 - .2 Disconnect Switch: 3R - Nema 3R.
 - .3 Wall Mount: round mounting base.
- .8 Acceptable Manufacturer's;
 - .1 PennBarry
 - .2 Greenheck

.3 Twin City

2.6 FUME EXTRACTION FAN (EF-16)

- .1 Centrifugal low-pressure blower type, direct drive motor with the fan housing bolted directly to the face of the motor.
- .2 Blower housing shall be 14 gauge c/w polyester epoxy lacquered galvanized sheet metal.
- .3 Housing c/w round outlet for flange, pipe or hose connection.
- .4 Blower wheel shall be die-cast aluminum-silicon.
- .5 Fan wheels shall be balanced to minimize vibration.
- .6 Motors shall be continuous duty type, high efficiency TEFC type suitable for indoor installation.
- .7 Accessories: Source capture arm as specified herein.
- .8 Fume extraction arm
 - .1 Exhaust arm: 1,8 mm (0.07 inch) thick aluminum with a white electrophoretic deposition coating to ensure corrosion resistance in 100 mm (4 inch) diameter.
 - .2 Swivel assembly:
 - .1 White powder coated hi-grade cast aluminum with 360-degree rotation. Jointed elbows shall be min. 4 mm (0.16 inch) thick polypropylene with glass fiber reinforcement.
 - .2 The elbows shall be 90-degree radius to minimize pressure drop and reduce noise.
 - .3 Knurled adjusting knobs supported by ball bearings are to be utilized at each friction joint. The two outermost joints of the arm shall rotate and swivel through 360 degrees.
 - .4 Adjustable external locking rings shall be incorporated to lock each respective joint in position.
 - .5 Duct mounting transition for coupling of external ductwork to the arm.
 - .6 Factory mounted support collar to support arm mounted to structural slab above.
 - .3 Duct transition shall be EPDM rubber.
 - .4 Capture hood constructed of 2 mm (0.08 inch) thick PET-G plastic. Minimum outside dimensions of 380 mm x 460 mm (15 inch x 18 inch). Plated steel hardware shall be included to mount the capture hood to the swivel arm.
 - .5 Mounting system consisting of base bracket for securing upper structure. Extension tube for securement of swivel assembly.
 - .6 Base bracket shall be constructed of cast aluminum.
 - .7 Extension tube shall be minimum 1100 mm (44 inch) in length, constructed of structural extruded aluminum.
- .9 Acceptable Manufacturer's;
 - .1 Nederman
 - .2 Monoxivent
 - .3 Maxair

2.1 AIR CURTAIN (AC-1, AC-2)

- .1 Cabinet:
 - .1 Aluminum base frame with stainless steel riveted construction and stainless steel cover.
 - .2 Dimensions: Not to exceed 14.25 in (36.2 cm) high by 15 in (38.1 cm) deep.
 - .3 Mounting: Provide for suspended mounting.
 - .4 Service Access: Removable combination screen and bottom access panel.
- .2 Motors: 3-speed, ODP, direct drive, resilient mounted, continuous duty, with internal thermal-overload protection and permanently lubricated sealed ball bearings.
- .3 Fans: Balanced forward curved type, double inlet, mounted in matched fan housings with aerodynamically formed air inlet venturis. Manufacture wheels and housings from galvanized steel.
- .4 Discharge Nozzles:
 - .1 Provide uniform velocity across width of air curtain.
 - .2 Aperture: 3.5 inch (9 cm) slot by width of air curtain.
- .5 Vanes: 1.5 in (3.8 cm) minimum height; constructed of airfoil-shaped aluminum extrusions; adjustable plus or minus 20 degrees to deflect airflow.
- .6 Inlet:
 - .1 Location: Front.
 - .2 Screen: Perforated pattern constructed of the same material and finish used for the cover.
- .7 Air Inlet Filter: Flat-faced fire rated re-cleanable aluminum with integral filter clips
- .8 CONTROLS
 - .1 Manual Switch: Factory installed "Fan On-Off" and "High-Med-Low" switches
 - .2 Basic Control Package: Air curtain turns on when door is opened and shuts off when door is closed.
 - .1 24 Volt Control: Magnetic reed style door switch and factory-installed transformer Disconnect Switch: Provide lockable remote mounted non-fused toggle disconnects based on number of power supplies required.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 – Vibration Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 – Air Duct Accessories.

- .2 Install explosion-proof fans in accordance with classification requirements.
- .3 Provide sheaves and belts required for final air balance.
- .4 Bearings and extension tubes to be easily accessible.
- .5 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation in concrete support pad in accordance with Section 03 30 00 – Cast-in-Place Concrete.

3.4 FIELD QUALITY CONTROL

- .1 Verification requirements include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Low-emitting materials.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 70 12 - Safety Requirements
- .4 Section 01 74 11 - Cleaning
- .5 Section 01 78 00 - Closeout Submittals

1.2 REFERENCES

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

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.
 - .1 DCC Representative will make available 1 copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in accordance with Section Section 01 74 19 - Waste Management and Disposal.

1.7 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.
 - .3 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

Part 2 Products

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified.
 - .3 Concealed fasteners.

- .3 Concealed manual volume control damper operators.

2.2 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.
- .2 Acceptable Manufacturer's;
 - .1 E.H. Price
 - .2 Kreuger
 - .3 Nailor

2.3 DIFFUSERS, GRILLES AND REGISTERS

- .1 As indicated in the schedule on the drawings.

2.4 RETURN GRILLES

- .1 Type E1: Louvred face, face frame for exposed duct mounting, c/w opposed blade damper. Appliance white finish.
- .2 Type E2: "Egg-crate", face frame for exposed duct mounting, c/w opposed blade damper. Appliance white finish.
- .3 Type R1: "Egg-crate", face frame for exposed duct mounting. Appliance white finish

2.5 DIFFUSERS

- .1 General: volume control dampers with flow straightening devices.
- .2 Type S1: steel double deflection type, having adjustable pattern, lay-in or surface mounted, c/w opposed blade damper. Finish: Appliance-white.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM):
 - .1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - .2 ASTM E2886/E2886M-20, Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement
- .2 National Research Council Canada (NRC):
 - .1 National Building Code of Canada 2020 (NBC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.3 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect louvers, intakes and vents from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section Section 01 74 19 - Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in accordance with Section 01 74 19 - Waste Management and Disposal

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 FIXED LOUVRES – ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 2 mm thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm maximum centres.
- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body
- .7 Screen: 12 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: factory applied enamel. Colour: to DCC Representative's approval.
- .9 Acceptable Material:
 - .1 Ventex
 - .2 Construction Specialties
 - .3 Ruskin

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative .

3.2 INSTALLATION

- .1 In accordance with manufacturer's and SMACNA recommendations

- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
- .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 and reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- | | | |
|-----|----------|---|
| .1 | 22 05 00 | Common Work Results for Mechanical. |
| .2 | 23 05 01 | Use of HVAC Systems During Construction. |
| .3 | 22 15 00 | General Service Compressed Air Systems |
| .4 | 26 05 00 | Common Work Results for Electrical |
| .5 | 26 05 20 | Wire and Box Connectors (0-1000V) |
| .6 | 26 05 21 | Wires and Cables (0-1000V) |
| .7 | 26 05 28 | Grounding – Secondary |
| .8 | 26 05 31 | Splitters, Junction, Pull Boxes and Cabinets |
| .9 | 26 05 32 | Outlet Boxes, Conduit Boxes and Fittings |
| .10 | 26 05 34 | Conduits, Conduit Fastenings and Conduit Fittings |
| .11 | 26 27 26 | Wiring Devices |
| .12 | 26 28 23 | Disconnect Switches – Fused and Non-fused |
| .13 | 26 50 00 | Lighting |
| .14 | 26 53 00 | Exit Signs |
| .15 | 28 31 00 | Multiplex Fire Alarm System |

1.2 REFERENCES

- | | |
|----|--|
| .1 | National Fire Protection Association (NFPA) |
| .1 | NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials |
| .2 | NFPA 30, Flammable and Combustible Liquids Code |
| .3 | NFPA 86, Standard for Ovens and Furnaces |
| .4 | NFPA 90a, Installation of Air Condition and Ventilating Systems |
| .5 | NFPA 90b, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems |
| .6 | NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids |
| .2 | National Fire Code of Canada (NFC) |
| .3 | Indoor Air Quality Association (IAQA) |

1.3 CODE COMPLIANCE

- | | |
|----|--|
| .1 | Paint spray booths and associated equipment shall be designed to meet the applicable requirements of NFPA 33.. |
| .2 | Submit detailed shop drawings to DCC Representative for review. Refer to submission details as stipulated in Part 2. |

1.4 PERSONNEL

- | | |
|----|--|
| .1 | Personnel performing the work described in this Section are to be experienced in installing paint spray booth systems for permitting and compliance with federal, Provincial and local health & safety laws and regulations. |
|----|--|

Part 2 Products

2.1 GENERAL

- .1 All products hereunder shall be fully designed and coordinated by one single manufacturer. Shop drawing submission shall include a fully coordinated assembly including paint booth enclosure, make-up air supply unit, exhaust components, and system control.
- .2 The shop drawings shall demonstrate clearly physical parameters for all major components, control system details including single line diagram and sequences of operation, performance characteristics of all make-up air, filtration, and exhaust components.
- .3 Drawings for the booth are in part diagrammatic. Manufacturers shop drawing submission shall reflect intended airflows and associated velocities in conjunction with operational and safety alarms/control, lighting levels, and integration with all associated equipment.
- .4 All fans, motorized damper actuators and control components shall be explosion-proof. All electrically powered equipment shall be compliant with the applicable regulation as determined by the zone classification. For hazardous areas, refer to requirements as specified in Division 26.

2.2 PAINT BOOTH

- .1 Pressurized, custom fabricated, dry filter down-draft paint booth.
- .2 Non-pressurized with Filtered Roof Intake Plenum:
 - .1 Clean air is introduced into the booth through a filtered intake at the top of the enclosure and is exhausted through a plenum below the finished floor of the booth. Air is pulled vertically from the ceiling of the booth through the working area at an average velocity of approximately 0.25 m/s (50 fpm). The intake and exhaust filter layout shall be designed for even air velocity throughout the working area of the booth. The intake plenum shall be designed with high efficiency intake filters to remove dust and dirt. The booth shall be designed with the maximized filter quantity to assure efficient particulate filtration from the intake and exhaust filters.
 - .2 Approximate Overall Dimensions: 8.5m Wide x 3.0m High x 14.0m Deep .
 - .3 Construction: Panels fabricated from 1.2mm galvanized steel panels. All panels shall be pre-punched and companion flanged for ease of assembly. The booth shall be rigidly reinforced with structural steel construction and shall be entirely self-supporting.

2.3 BOOTH MODES OF OPERATION

- .1 This Booth shall be capable of operating be within the ranges indicated below.
- .2 Paint Mode: The total airflow during Paint Mode shall be 30,200 L/S (64,000 CFM). Paint Mode shall be designed for full velocity in the booth to remove paint overspray. Paint Mode shall be a 100% outside air mode and temperature shall be maintained at a minimum of 21.2° C (70° F).

- .3 Bake Mode: The Make-Up Air Unit shall be provided with a variable speed motor and damper package to discharge air at a minimum of 60 ° C (140 ° F) during the bake cycle. System controls shall reduce airflow during the bake cycle. System shall operate using 100% outdoor air supply during this cycle. Controls shall include an auto-balance system controlling variable frequency drives (VFD) to automatically adjust the airflow of the exhaust fan to ensure proper booth balance.

2.4 BOOTH EXHAUST SYSTEM

- .1 Mixed-Flow in-line exhaust fan as specified in Section 23 34 00 -HVAC Fans
- .2 Exhaust filters shall be wave style c/w holding frame to support with floor grates.
- .3 Modular floor grate assembly, steel construction, 40mm thick.
- .4 Exhaust duct connection at base of booth assembly, sized to accept full exhaust airflow.

2.5 BOOTH INTAKE SYSTEM

- .1 Reference Section 23 54 16_Fuel-Fired Furnaces
- .2 Roof assembled intake air plenum designed to equalize air velocity through the booth operational area. Connection collars to accept make-up air supply discharge.
- .3 High temperature filter media fabricated from polyester fibre, suitable for operation up to 104 °C (220 °F)

2.6 BOOTH CONTROLS

- .1 Booth control panel (575v. 3ph. 3 wire). The control system is an automated control system. The control panel shall be fabricated with the following components:
 - .1 Type 12 industrial panel with main disconnect, and door mounted disconnect handle.
 - .2 Motor starters or variable frequency drives (VFD's) with branch circuit, and overload protection per NEC Article 430. For both MUA and EF related to paint booth.
 - .3 Control Transformer with primary/secondary fusing.
 - .4 Control logic to automatically balance supply and exhaust airflows to maintain booth interior pressures.
 - .5 Lighting branch circuits/transformer and contactor.
 - .6 Control power supply 120vac/24vdc (through control transformer)
 - .7 Air Flow Switches and interlocks.
 - .8 Integrated shut-down functions (man-down, paint spray, etc.)
 - .9 Terminal Strip and Wire Gutters for easy connection of field wiring
 - .10 Programmable Logic Controller (PLC)
 - .11 Operator Interface Screen (HMI) Standard 5.7" minimum, monochrome or color.
 - .12 Complete control panel shall be CSA C22.2 compliant.
- .2 Paint Curing System with Variable Air Volume:
 - .1 The air replacement unit shall be designed with a variable frequency drive to discharge 60°C (140-degree F) air minimum. The system shall be designed to reduce airflow during the curing mode.

- .3 Economizer System:
 - .1 The air replacement unit shall be designed with a variable frequency drive and damper package. The system shall be designed to reduce airflow to 50% during the energy saving mode.
 - .2 Provide a gun support switch, located inside of the booth to control the booth function from paint mode to energy saving mode. System controls shall be configured to automatically switch to the saving mode when paint spray functions have ceased.
 - .3 Provide manual override switch at booth control panel to continue 100% airflow as selected by equipment operator.
- .4 Provide a differential pressure gauge and sensing probes and a variable frequency drive (VFD) to control the speed of the intake fan motor to maintain equally balanced supply and exhaust air volume.

2.7 BOOTH ACCESSORIES

- .1 “Man Down” alarm; Provide pull string secured to full interior perimeter to activate a minimum of three (3) remote audible and visual alarm devices (one at paint booth control panel, one in Corridor 100C, one in Corridor 100A). Activation of “man down” alarm shall deactivate all painting operations when activated.
- .2 LED light fixtures, inside access 1.22 m (48"), 120V with minimum 4000K CRI color rendering. Light fixture body itself is mounted on exterior of paint booth, outside of Zone 1 area. Provide baked white enamel finish that creates a durable highly reflective light fixture. Lights shall be rated for Class I, Division 2, Groups A, B, C, and D (Class I, Zone 2, Group IIA minimum) where lights are mounted on exterior of paint booth. Lights shall be ETL & ETL-C listed, or CSA listed and/or listed with marks allowed to be used in Canada per the CEC. They are also to be listed for locations having deposits of readily combustible dust. Provide interlock switch to disable painting operations when light access door is opened. Provide lighting to meet the required 750 Lux average for both vertical and horizontal planes per IES standards, CRI of 4000K. Provide ceiling lighting as well as wall mounted lighting to meet the requirements. Lighting indicated on electrical drawings for the booth are in part diagrammatic and this contractor/supplier is to provide what is required to meet these levels.
- .3 Provide bi-folding product entry doors minimum 6.1m wide x 3.0m high . Doors shall be 50.8mm tube framed and double skinned with 1.2 mm galvanized sheet steel. Door hinges shall be heavy duty. Provide an airtight seal with P-Seal rubber gasket.
 - .1 Provide viewing panel in each door assembly encompassing a minimum of 50% total surface area. Viewing panel shall be constructed of clear tempered glass.
- .4 Provide minimum two (2) observation panels in booth enclosure; 450mm w x 600mm) clear tempered class.
- .5 Provide access doors with panic latch minimum 914mm Wide x 2,134 mm High with 450mm x 600mm clear tempered glass observation window.
- .6 Provide Class 1 Division 2 (Zone 2) limit switches to detect booth door open during operation and disable spray functions after a timed delay.
- .7 Provide 20mm (¾") 3-way solenoid valves to prevent spraying in booth when fans are off or light tube access door is opened (NFPA-33 requirement)

- .8 Compressed Air Hose Reels; Reference Section 22 15 00 – General Service Compressed Air Systems.
 - .1 Compressed air Manifolds inside the booth;
 - .1 Seven (7) minimum locations, one in middle of back wall without bifold doors, Three (3) on each side wall equally spaced. Reference plans for approximate location.
 - .2 Manifolds shall have Air pressure regulator with gauge and oil water separator. Each manifold shall have 3 compressed air quick connects fitted with I/M Style ISO 4414 Industrial Interchange, Safety venting coupler Quick Connect Air coupler
- .9 Breathing Air Apparatus;
 - .1 Paint booth shall be fabricated with breathing air distribution piping adjacent to all Compressed air manifolds. Provide Header box and hose assemblies for future connection to breathing air supply. All breathing air tubing routed into paint booth to be threaded for NPT standard connections and capped to prevent infiltration of foreign materials. Main trunk line to be capped to prevent contamination..
 - .2 Air Filtration Panel; four (4) worker assembly, carbon monoxide sensor and monitoring, 169 m³/hr (100 cfm) air @ 0.34- 8.6 bar (5-125 psi) operating range, portable case with vision panel, 5 micron air filter and housing, brass quick connect for distribution air, 120V/1Ø power to monitoring sensor and alarm, battery backup, audible and visual alarm.
- .10 Magnahelic gauge to indicate cabin pressure is balanced and suitable for spray operation.
- .11 Provide all necessary assembly hardware including anchor bolts and exploded view installation drawings.
- .12 Provide full system commissioning using factory trained representatives.
- .13 Provide on-site system training for site personnel on operation and maintenance of spray booth ,air make-up unit, and exhaust fan assembly.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for paint spray booth systems equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 WORK AREA PREPARATION

- .1 Protect all furnishings, equipment, etc. in work area with polyethylene or equivalent.

- .2 Seal off ends and openings of any ductwork, not being immediately worked on.
- .3 Suitably support and brace any ductwork which will be entered by personnel for decontamination, if deemed necessary by cleaning contactor.
- .4 Lock out power supply to appropriate air handling equipment.

3.3 INSTALLATION

- .1 Install equipment as indicated in compliance with manufacturer's instructions and the related specification sections.

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 recycling and reuse in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 22 05 00 - Common Work Results for Mechanical.
- .2 Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- .3 Section 23 07 13 – Duct Insulation.
- .4 Section 23 31 13.01 – Metal Ducts - Low Pressure to 500 Pa.
- .5 Section 23 33 15 - Dampers - Operating.

1.2 REFERENCES

- .1 American National Standards Institute/Air-Conditioning, Heating, and Refrigeration Institute (ANSI/AHRI)
 - .1 ANSI Z83.4-2017 (R2022)/CSA 3.7-2017 (R2022); Non-recirculating direct gas-fired heating and forced ventilation appliances for commercial and industrial application
 - .2 ANSI Z83.8-2016 (R2021)/CSA 2.6-2016 (R2021); Gas unit heaters, gas packaged heaters, gas utility heaters, and gas-fired duct furnaces
- .2 American National Standards Institute (ANSI)/Air Movement and Control Association International (AMCA)
 - .1 ANSI/AMCA 204-05 (R2012); Balance Quality And Vibration Levels For Fans
- .3 American National Standards Institute/American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI/ASHRAE/IES).
 - .2 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .4 CSA Group (CSA):
 - .1 CSA E60730-1A:15 (R2020); Amendment 1:2017 to CSA E60730-1:15, Automatic electrical controls – Part 1: General requirements (Adopted amendment 1:2015 to IEC 60730-1:2013)
 - .2 CAN/CSA-E60730-1:13; Automatic electrical controls for household and similar use - Part 1: General requirements (Adopted IEC/CEI 60730-1:2010, fourth edition, 2010-03, with Canadian deviations)

1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation, filters, adhesives, and paints, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate following: fan curves showing point of operation motor drive, bearings, filters, mixing box, dampers and coil; include performance data.

- .4 Submit Test and Evaluation Report.
- .5 Submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Submit manufacturers' warranty.
- .3 Operation and Maintenance Data: Submit and incorporate into operation and maintenance manual recommended maintenance procedures, maintenance schedule for components, parts list of major components, and troubleshooting guide.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one spare set of pre and after filters for each unit.
- .3 Spare filters: in addition to filters installed immediately prior to acceptance by DCC Representative, supply 1 complete set of filters for each filter unit or filter bank.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in a clean, dry location, and in accordance with manufacturer's recommendations.
 - .2 Store and protect from nicks, scratches, and blemishes.
- .4 Packaging Waste Management: remove for reuse of pallets crates padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

- .1 Pre-wired equipment shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the Canadian Standards Association.

2.2 OUTDOOR MAKE-UP UNITS (MUA-3)

- .1 GENERAL
 - .1 Certified in accordance with CSA Standard for Gas Unit Heaters And Gas-Fired Duct Furnaces ANSI Z83.4 and CSA 3.7.
 - .2 Performance: As specified on Drawing Schedules.
- .2 CABINET
 - .1 Wall construction, minimum 18-gauge G-90 galvanized steel.
 - .2 Floor construction minimum 16-gauge G-90 galvanized steel.

- .3 Floor and wall panels shall be sealed airtight.
- .4 Casing panels shall be removable for field servicing.
- .5 The unit base shall be suitable for curb mount. Casing construction shall be suitable for outdoor installation.
- .6 All controls, gas valves, modulating controls and electrical components shall be mounted within a control enclosure.
- .7 Full size hinged access doors shall have a minimum of two (2) latches. All access doors shall have a continuous aluminum hinge with stainless steel pin.
- .8 Latches shall be a heavy duty with sealing gasket to prevent water leakage.

.3 AIRFLOW CONFIGURATIONS

- .1 Unit shall be horizontal discharge from the unit.
- .2 100 percent outdoor air unit intake's airflow configuration shall be through use of a fresh/outdoor damper.
 - .1 Damper: Shall exceed AMCA Class 1A standard for low leakage.
 - .2 Actuator: A direct-drive damper actuator shall be used with spring return to ensure that the outdoor air section opens when not powered.

.4 SUPPLY AIR BLOWER AND MOTOR

- .1 Blower Motor: Premium efficiency motor ,open drip proof (ODP) driven by a variable frequency drive.
- .2 Fans shall be selected at or near efficiency peak.
- .3 Blower and motor assembly shall be dynamically balanced. Wheels balanced as per AMCA 204- Balance Quality and Vibration Levels for fans.
- .4 All blowers shall be tested and set at rated speed after being installed in the factory assembled unit.
- .5 Motor shall have an adjustable drive with a 1.15 service factor. Blower motor shall have an adjustable mount, made of heavy gauge steel.

.5 SHAFTS AND BEARINGS

- .1 Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings designed for and individually tested specifically for use in air handling applications.

.6 HEATING SYSTEM

- .1 The gas burner shall use natural gas at a minimum/maximum inlet-supply pressure to the unit of 2 psi.
- .2 Burner design shall be capable of using natural gas. Burner ignition shall be of the direct-spark design with remote flame sensing at the pilot assembly to detect the presence of flame in the burner.
- .3 Each furnace shall have:
 - .1 burner with stainless steel combustion baffles and ductile aluminum gas-supply section with no moving parts. The burner shall be capable of 92% combustion efficiency with minimum turndown ratio of 15 to 1.
 - .2 Manifold and Input gas pressure gauges.
 - .3 Manual reset high temperature limit switch.
 - .4 High gas-pressure switch.
 - .5 Low gas-pressure switch.
 - .6 Proof-of-closure switch to energize the main-burner circuit only if the motorized gas valve is in a closed position.

.7 FILTERS

- .1 The filters shall be 50mm thick, pleated, minimum MERV 8. Filter media is supported on the air leaving side by a metal grid.

- .2 All filters shall be installed on tracks for easy removal from the unit.
- .3 Galvanized steel housing with internal slides and removable access panels.

.8 ELECTRICAL

- .1 All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against risk of condensation.
- .2 Single point electrical connection.
- .3 Door safety switch shall de-energize supply fan when door is opened.
- .4 Factory mounted averaging intake air temperature sensor.
- .5 The electrical cabinet shall be outfitted with the following:
 - .1 LED electrical cabinet service light with automatic activation upon door switch.
 - .2 Color wiring schematics laminated and secured to the interior wall of the cabinet doors.
 - .3 Factory mounted disconnect.
 - .4 Local control panel mounted within the unit's control cabinet to allow for all set points configuration and monitoring at the unit.

.9 CONTROLS

- .1 Control board to allow for full control of the entire unit. **Unit control shall be capable of all operations required for paint booth functions, including paint spray and bake mode.**
- .2 Air flow switch to sense air flow.
- .3 Temperature Control System:
 - .1 Discharge Temp Control (Heating) - Unit modulates the burner flame to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls.
 - .2 **Unit shall be capable of achieving minimum 60 ° C (140 ° F) discharge air temperature to accommodate paint booth "bake" cycle.**
- .4 Activation Controls:
 - .1 Activate Based on Intake (Heating) - Unit will activate heating when the intake temperature drops below the desired set point.

.10 CURBS

- .1 900mm high, factory assembled, and constructed of 12-gauge galvanized steel.
- .2 Seismic bracing as required by certified Seismic Engineer.

.11 VARIABLE FREQUENCY DRIVES

- .1 Variable Frequency Drive to control speed on all direct drive supply fans.
- .2 VFD shall include the following inherent protections:
 - .1 Phase protection.
 - .2 Brownout protection.
 - .3 Overload/Overheat protection.
 - .4 Soft starts to protect bearings/hardware.
 - .5 Low & High voltage & over-torque protections.
 - .6 Service bypass.

2.3 INDOOR MAKE-UP UNIT (MUA-4)

.1 GENERAL:

- .1 Certified in accordance with Standard, ANSI Z83.8 and CSA 2.6.
- .2 Performance: As specified on Drawing Schedules.

.2 CASING:

- .1 20 Gauge G-90 galvanized steel. Unit base shall be suitable for flat mount. Base shall be structurally reinforced to accommodate the blower assembly and burner. Housing construction shall be suitable for indoor installation.
- .2 Configured for horizontal discharge.
- .3 All electrical controls on the control board shall be mounted in an isolated, fully enclosed enclosure, completely separated from any combustion air, accessible for servicing.
- .4 All gas valves and electrical safety-limits shall be mounted within the burner vestibule.
- .5 Provide full-size access doors for easy access to controls, gas-train, blower, motor and drives.

.3 BLOWER:

- .1 Forward-curved, centrifugal, double width, double inlet, constructed of galvanized steel. Heavy-duty, solid-steel shaft. Wheels shall be balanced in two planes in accordance with AMCA standard 204, Balance Quality and Vibration Levels for Fans.
- .2 Wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan shaft.
- .3 Blower assembly shall be isolated from the fan structure with vibration isolators.

.4 MOTOR & MOTOR COMPARTMENT:

- .1 Heavy duty ball bearing type.
- .2 Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of belt tension.
- .3 Blower motor shall be suitable for operation on 575 volts, 60 cycle, 3 phase power, Open Drip Proof.

.5 SHAFT & BEARINGS

- .1 Precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours.

.6 BELTS & DRIVES

- .1 Belts; Oil and heat resistant, non-static, grip-notch type.
- .2 Drives; cast type, precision machined and keyed and secured attached to the fan and motor shafts.
- .3 Fan operating speed shall be factory set using adjustable pitch motor pulleys.

.7 BURNER & HEAT EXCHANGER

- .1 Gas burner shall be an indirect-fired, push-through type using natural gas at an inlet-supply pressure to the unit of 7" w.c. minimum Nat. Gas, inches water column. Provide gas pressure regulator to reduce building gas supply from 2 psi to 7" wc.
- .2 Burner shall be a tubular type designed for natural gas. Direct-spark ignition design with remote flame sensing.
- .3 Electronic fully modulating control system capable of achieving 80% combustion efficiency over the entire gas firing range of the unit.
- .4 Each furnace shall have:
 - .1 Minimum turndown ratio of 6:1 for natural gas.
 - .2 Heat exchanger; 409 stainless steel.
 - .3 Blocked vent safety airflow switch.
 - .4 High temperature auto-recycling limit with a maximum non-adjustable set-point of 200F.
 - .5 Manual reset high temperature flame roll out switch with a non-adjustable set-point of 325F.

- .6 Power-vent assembly for exhausting flue gases.
 - .5 Furnace module gas inlet shall be equipped with a 0-35" w.c. gas pressure gauge and 0-10" w.c. gas pressure gauge on the gas manifold.
- .8 GAS EQUIPMENT:
 - .1 Modulating-gas valve
 - .2 Burner
 - .3 Main-gas shut-off valve
 - .4 Main-gas regulator
 - .5 Solenoid valve
 - .6 All gas manifold components shall be piped and wired at the factory.
- .9 SAFETY CONTROLS
 - .1 Motor starter with adjustable overloads
 - .2 Main air-flow safety switch
 - .3 Electronic flame-safety relay
 - .4 High-temperature limit switch
 - .5 Non-fused disconnect
 - .6 Flame roll-out switch
 - .7 Main-gas regulator
 - .8 Solenoid valve
 - .9 Combustion air-proving switch
- .10 ACCESSORIES
 - .1 Filters: 50mm, minimum MERV 8. Filter media supported on leaving side by a metal grid supported with internal slides and with removable access panels.
- .11 TEMPERATURE CONTROL SYSTEMS:
 - .1 Interface with local BAS room sensor and controller.
 - .2 Ability to activate heating based on any of the following.
 - .1 Intake temperature
 - .2 Space temperature
 - .3 Intake and space temperature
 - .4 Intake or space temperature
 - .3 Ability to control heating based on any of the following.
 - .1 Discharge – Unit shall modulate to maintain discharge temperature.
 - .2 Space – Unit shall modulate to maintain space temperature.
 - .3 Controlled via BAS controller (0-20mA, 4-20 mA, 0-10V, or 2-10V).
- .12 BLOWER MODE:
 - .1 Manual (On) – Blower shall run constantly.
 - .2 Auto – Blower shall only run on a call for heating.
 - .3 Interlock (Off) – Blower shall only run when unit interlock is energized.
- .13 WIRING AND ELECTRICAL
 - .1 Control circuit voltage shall be 24 volts.
 - .2 Control transformer for line to low voltage.
 - .3 120 V, 1Ø power for service outlet.
 - .4 Motor starter; line voltage.

- .5 Provide relays, starters, switches, safety controls, conduit and wire as required for proper operation.
- .6 All factory-mounted controls shall be factory prewired to the unit control panel.
- .7 Single point electrical connection.
- .8 Blower-on delay timer to pre-heat the heat-exchanger prior to energizing the main blower.
- .9 Convenience outlet on control board with 120 Vac service.
- .10 Freeze-stat with adjustable temperature set point to shut down the main blower in case of burner failure.
- .11 Fire stat with adjustable set-point temperature.
- .12 Dirty filter airflow switch with LED indicator light.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed are acceptable for fuel-fired furnaces installation in accordance with manufacturer's instructions.
 - .1 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions, regulations of authorities having jurisdiction and to CSA B149.1, Canadian Electric Code and CSA C22.1.
- .2 Locate furnace allowing accessibility for service and filter changes
- .3 Check for free rotation of fan
- .4 Ensure alignment of fan and motor pulleys
- .5 Ensure proper belt tension, where occurring
- .6 Make connections to line, thermostats, and humidistat in accordance with manufacturer's instructions
- .7 Coordinate with concrete work regarding concrete bases as indicated on drawings
- .8 Smoke density: Maximum 1, tested to ASTM D2156.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA):
 - .1 CSA C22.2 No.155-M86 (R2022), Electric Duct Heaters

1.2 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC
- .2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
- .3 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC
- .4 Section 26 05 00 - Common Work Results for Electrical

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, product literature and data sheets for duct heaters and controls and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings showing:
 - .1 Element support details.
 - .2 Unit support.
 - .3 Internal components wiring diagrams.
- .4 Submit duct heater schedule indicating quantities, sizes, mounting arrangement and the following performance data:
 - .1 Electrical: total kW rating, voltage, phase.
 - .2 Heater element watt/density.
 - .3 Controller type.
 - .4 Number of stages and kW rating.
 - .5 Minimum operating airflow.
 - .6 Maximum discharge temperature.
 - .7 Pressure drop at operating minimum airflow.
 - .8 Accessories included.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section Section 01 61 00 - Common Product Requirements and Section 23 05 00 - Common Work Results for HVAC.

Part 2 Products

.1 EXPLOSION RATED DUCT COIL

- .1 Electric explosion proof duct heaters of the KW rating, voltage, phase, duct size and airflow direction specified in the drawing schedules.
- .2 CSA Approved for Class I, Divisions 1 and 2, Groups C and D; Class II, Divisions 1 and 2, Groups E, F and G, Ignition Temperature Code No. T3C, 320°F (160°C)
- .3 Automatic and manual reset thermal cutouts for redundant overtemperature protection, fan relay for airflow interlock, de-energizing controlling and backup magnetic contactors, 24 Volt control circuit transformer, terminal blocks for field wiring. Controls shall be housed in a NEMA 7, 9 cast aluminum enclosure.
- .4 Heat exchanger shall be liquid-to-air design, utilizing a copper tube core with integral aluminum fins. Non-toxic, inhibited, propylene glycol heat transfer fluid shall provide freeze protection down to -40°F (-40°C). Industrial grade electric heating elements.
- .5 Pressure relief valve set at 70 psig.
- .6 Control Accessories below:
 - .1 SCR temperature controller with remote thermostat.
 - .2 Disconnect switch with external handle.
 - .3 Airflow proving switch.
 - .4 Fan relay.
- .7 Acceptable Materials;
 - .1 Indeeco
 - .2 Chromalox
 - .3 Wattco

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify site conditions are acceptable for duct heater installation in accordance with manufacturer's written instructions.
 - .1 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative .

3.2 INSTALLATION

- .1 Perform installation in accordance with manufacturer's instructions.
- .2 Locate duct heater in accordance with manufacturer's minimum recommended distances for operation, service access and unit removal.

- .3 Provide additional hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment where duct heater weight cannot be supported solely by existing duct.
- .4 Make power and control connections to CSA C22.2 No.155
- .5 Verify that ductwork and casings are free of debris before operating and testing duct heaters.

3.3 SITE QUALITY CONTROL

- .1 Perform tests in accordance with Section 01 91 00 - Commissioning.
- .2 Duct Heater Controls: test operation of safety controls and duct heater staging/modulation by simulating a demand from the local thermostat or external control signal.
- .3 Site Adjustments: test and adjust airflow controls during system testing, adjusting and balancing in coordination with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .4 Perform tests in presence of DCC Representative .
 - .1 Submit test report and include copy with Operations and Maintenance Manuals.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .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 19 - Waste Management and Disposal

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 61 00 – Common Product Requirements.
- .3 Section 01 78 00 – Closeout Submittals

1.2 REFERENCES

- .1 International Electrotechnical Commission (IEC)
 - .1 IEC 947-4-1, Part 4: Contactors and motor-starters.

1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals

1.5 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 GENERAL DESCRIPTION

- .1 The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage as defined in the following sections.
- .2 The input power section shall utilize a full wave bridge design incorporating diode rectifiers and input line filters. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. This power section shall be insensitive to phase rotation of the AC line.
- .3 The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize insulated gate bipolar transistors (IGBTs) or intelligent power modules (IPMS) as required by the current rating of the motor.

- .4 The VFDs shall include for built in transient voltage surge suppression (TVSS).
- .5 All mechanical equipment requiring diagnostic software, or devices, necessary to adequately service equipment specified herein shall be included with the equipment purchase.

2.2 CONSTRUCTION

- .1 The AC Drive shall be in a drip proof enclosure.

2.3 APPLICATION DATA

- .1 The AC Drive shall be sized to operate a Variable Torque load.
- .2 The speed range shall be from a minimum speed of 0.0 Hertz to a maximum speed of 120 Hertz standard.

2.4 ENVIRONMENTAL RATINGS

- .1 The AC Drive shall be construction that allows operation in a pollution Degree 3 environment. The AC Drive shall meet IEC 664-1 and NEMA ICS 1 Standards.
- .2 The AC Drive shall be designed to operate in an ambient temperature from 0°C to +40°C (+32°F to 104°F).
- .3 The storage temperature range shall be -20°C to +70°C.
- .4 The maximum relative humidity shall be 95% at 40°C, non-condensing.

2.5 RATINGS

- .1 The AC Drive shall be designed to operate from an input nominal voltage of 600V + 10%/-15% VAC. No transformers shall be used on either the input or output of the AC Drive.
- .2 The AC Drive shall operate from an input voltage frequency range from 48 to 62 Hertz.
- .3 The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.
- .4 The efficiency of the AC Drive at 100% speed and load shall not be less than 96%.

2.6 PROTECTION

- .1 Upon power-up, the AC Drive shall automatically test for valid operation of memory, loss of analog reference input, dynamic brake failure, control power and the pre-charge circuit.
- .2 The AC Drive shall be UL 508C listed for use on distribution systems with 18,000A RMS available fault current.
- .3 The Power Converter shall be protected against short circuits between, output phases, and ground. The AC Drive shall safely shut down without damaging any power circuit devices.
- .4 The AC Drive shall have an internal over temperature protection.

- .5 Instantaneous Over current Protection: The VFD output shall be turned off if the operating current exceeds the specified level.
- .6 Motor Overload Protection: CSA approved electronic thermal overload protection.
- .7 External Trip Input: Programmable for either N/O or N/C operation.
- .8 Phase Loss Protection: To prevent single phasing of the VFD input.
- .9 Unattended Start Protection: User selectable function to prevent an automatic restart after an interruption in input power.
- .10 Over Voltage Protection: The VFD output shall turn off if the DC Bus voltage exceeds the specified level.
- .11 Ground Fault Protection: The VFD output shall turn off in the event of a ground fault.
- .12 Software Lock: The VFD shall include a software function that prevents changes to the user-defined settings.
- .13 CPU or EEPROM Error: The VFD output shall turn off in the event of an error in the CPU or EEPROM.
- .14 Current relays shall be automatically calibrating and VFD rated.

2.7 ADJUSTMENTS AND CONFIGURATIONS

- .1 Adjustable acceleration and deceleration ramp times.
- .2 The volts per frequency ratios shall be user selectable to meet variable torque loads, normal and high torque machine applications.
- .3 The memory shall retain and record run status, date and time, fault type of the past 10 faults.
- .4 Slip compensation shall be a software enabled function.
- .5 The AC Drive shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator continuously, on start, on stop or at zero speed. The level of current will be adjustable between 20-180% of rated current.
- .6 As a minimum, the following parameters shall be accessible:
 - .1 Maximum speed
 - .2 Minimum speed
 - .3 Current limit
 - .4 Thermal overload
 - .5 Restart limit
 - .6 Skip frequency and bandwidth
 - .7 Preset speed

2.8 OPERATOR

- .1 The operator interface terminal will offer the modification of AC drive adjustments. All electrical values, configuration parameters, application and activity function access, faults, local control, adjustment storage will be in plain English.
- .2 The display will be a high resolution, LCD backlighted screen.
- .3 Display Values:
 - .1 Run status.
 - .2 Set speed with speed units (Hz, RPM, % RPM).
 - .3 Load with load units (% load, amps).
 - .4 Rotational direction.
 - .5 Speed reference source (keypad, potentiometer, 0-10VDC, 4-20 mA).
 - .6 Time Since Start.
 - .7 Total Run Time.
 - .8 Total Kilowatts-Hours.
 - .9 Hours Until Maintenance Required.
- .4 The following control functions shall be available to the operator:
 - .1 Start (Manual Mode).
 - .2 Stop (Auto/Manual, Remote/Local mode).
 - .3 Jog (Local Mode).
 - .4 Auto/Manual (if Auto Mode is enabled).
 - .5 Forward/Reverse (if Forward +Reverse function is enabled).

2.9 CONTROL

- .1 External pilot devices shall be able to be connected to a terminal strip for starting/stopping the AC Drive, speed control and displaying operating status. All outputs will be software assignable.
- .2 The control power for the digital inputs and outputs shall be 24 VDC.
- .3 There will be two (2) analog inputs. The analog inputs will be hardware selectable and consist of the following configurations: 4-20 mA, 20-4 mA, 0-10 V or 10-0 V.
- .4 There will be two (2) software assignable analog outputs that can be selected and assigned in the software. The analog output assignments shall be proportional to the following motor characteristics: 0-110% speed, 0-110% load. The output signal will be selectable from 4-20 mA, 0-10 VDC or 12 VDC pulsed.
- .5 Two form "C" configurable relay output contacts and an open collector output (24 VDC) to power a relay or pilot light, shall be provided. Each shall be programmable to indicate one of the following:
 - .1 Run
 - .2 Fault
 - .3 Fault lock-out
 - .4 At speed
 - .5 Current limit
 - .6 Follower present

- .7 Auto speed mode
- .8 Start pending
- .9 Above set speed
- .10 Maintenance target

- .6 Ensure Variable Speed Drive is supplied with a relay to interconnect with a disconnect switch.

2.10 INPUT AND OUTPUT FILTERING

- .1 All VFDs shall be furnished with the following protective devices as a minimum:
 - .1 Provide 5% impedance k-rated line isolation transformer for the reduction of line harmonics and to limit line voltage transients

2.11 MANUAL BYPASS SWITCH

- .1 Manual bypass switch with key interlock to prevent closing unless VSD is off line. Bypass switch shall be rated to open and close under load.

2.12 ACCEPTABLE MATERIALS

- .1 ABB
- .2 Danfoss
- .3 Siemens

Part 3 Execution

3.1 INSTALLATION

- .1 Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.
- .2 The AC Drive manufacturer shall provide a factory certified technical representative to supervise the contractor's installation, testing and start-up of the AC drive(s) furnished under this specification.

3.2 TRAINING

- .1 An on-site training course of one (1) training day shall be provided by a representative of the AC Drive supplier to plant and/or maintenance personnel.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Methods and procedures for start-up, verification and commissioning, for building control systems and includes:
 - .1 Start-up testing and verification of systems.
 - .2 Check out demonstration or proper operation of components.
 - .3 On-site operational tests.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittals
- .2 Section 01 78 00 - Closeout Submittals
- .3 Section 01 79 00 - Demonstration and Training.
- .4 Section 25 05 01 - General Requirements.

1.3 DEFINITIONS

- .1 For additional acronyms and definitions refer to Section 25 05 01 - General Requirements.
- .2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.
- .3 Downtime: results whenever control systems are unable to fulfill required functions due to malfunction of equipment defined under responsibility of control contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - .1 Outage of main power supply in excess of back-up power sources, provided that:
 - .1 Automatic initiation of back-up was accomplished.
 - .2 Automatic shut-down and re-start of components was as specified.
 - .2 Failure of communications link provided that:
 - .1 Controller automatically and correctly operated in stand-alone mode.
 - .2 Failure was not due to failure of any specified control equipment.
 - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
 - .1 System recorded said fault.
 - .2 Equipment defaulted to fail-safe mode.
 - .3 AEL of total of all input sensors and output devices is at least 95% during test period.

1.4 DESIGN REQUIREMENTS

- .1 Confirm with DCC Representative that Design Criteria and Design Intent are still applicable.

- .2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittals.
- .2 Final Report: submit report to DCC Representative.
 - .1 Include measurements, final settings and certified test results.
 - .2 Bear signature of commissioning technician and supervisor.
 - .3 Report format to be approved by DCC Representative before commissioning is started.
 - .4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to control systems as set during commissioning and submit to DCC Representative in accordance with Section 01 78 00 - Closeout Submittals.
 - .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide documentation, O M Manuals, and training of O M personnel for review of DCC Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals.

1.7 COMMISSIONING

- .1 Carry out commissioning under direction of DCC Representative and in presence of DCC Representative.
- .2 Inform, and obtain approval from, DCC Representative in writing at least 14 days prior to commissioning or each test. Indicate:
 - .1 Location and part of system to be tested or commissioned.
 - .2 Testing/commissioning procedures, anticipated results.
 - .3 Names of testing/commissioning personnel.
- .3 Correct deficiencies, re-test in presence of DCC Representative until satisfactory performance is obtained.
- .4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .5 Load system with project software.
- .6 Perform tests as required.

1.8 COMPLETION OF COMMISSIONING

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by DCC Representative.

1.9 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

- .1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Part 2 Products

2.1 EQUIPMENT

- .1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.
- .2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.
- .3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.
- .4 Locations to be approved, readily accessible and readable.
- .5 Application: to conform to normal industry standards.

Part 3 Execution

3.1 PROCEDURES

- .1 Test each system independently and then in unison with other related systems.
- .2 Commission each system using procedures approved by the DCC Representative.
- .3 Commission integrated systems using procedures approved by DCC Representative.
- .4 Debug system software.
- .5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

3.2 FIELD QUALITY CONTROL

- .1 Pre-Installation Testing.
 - .1 General: consists of field tests of equipment just prior to installation.
 - .2 Testing may be on site or at Contractor's premises as approved by DCC Representative.
 - .3 Configure major components to be tested in same architecture as designed system. Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
 - .4 Additional instruments to include:
 - .1 DP transmitters.
 - .2 DP switches used for dirty filter indication and fan status.
 - .5 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.
 - .6 After setting, test zero and span in 10% increments through entire range while both increasing and decreasing pressure.
 - .7 DCC Representative to mark instruments tracking within % in both directions as "approved for installation".
 - .8 Transmitters above 0.5% error will be rejected.
 - .9 DP switches to open and close within 2% of setpoint.

- .2 Completion Testing.
 - .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
 - .2 Include following activities:
 - .1 Test and calibrate field hardware including stand-alone capability of each controller.
 - .2 Verify each A-to-D convertor.
 - .3 Test and calibrate each AI using calibrated digital instruments.
 - .4 Test each DI to ensure proper settings and switching contacts.
 - .5 Test each DO to ensure proper operation and lag time.
 - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
 - .7 Test operating software.
 - .8 Test application software.
 - .9 Verify each CDL including energy optimization programs.
 - .10 Debug software.
 - .11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
 - .12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and DCC Representative. This document will be used in final startup testing.
 - .3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of DCC Representative and provide:
 - .1 2 technical personnel capable of re-calibrating field hardware and modifying software.
 - .2 Detailed daily schedule showing items to be tested and personnel available.
 - .3 DCC Representative's acceptance signature to be on executive and applications programs.
 - .4 Commissioning to commence during final startup testing.
 - .5 O M personnel to assist in commissioning procedures as part of training.
 - .6 Commissioning to be supervised by qualified supervisory personnel and DCC Representative.
 - .7 Commission systems considered as life safety systems before affected parts of the facility are occupied.
 - .8 Operate systems as long as necessary to commission entire project.
 - .9 Monitor progress and keep detailed records of activities and results.
 - .4 Final Operational Testing: to demonstrate that control system functions in accordance with contract requirements.
 - .1 Demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
 - .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

- .2 Tests to include:
 - .1 Demonstration of correct operation of monitored and controlled points.
 - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
- .3 System will be accepted when:
 - .1 Control equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
 - .2 Requirements of Contract have been met.
- .4 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .5 Correct defects when they occur and before resuming tests.
- .5 DCC Representative to verify reported results.

3.3 ADJUSTING

- .1 Final adjusting: upon completion of commissioning as reviewed by DCC Representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

- .1 Demonstrate to DCC Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 79 00 - Demonstration and Training.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for training program, instructors and training materials, for building Control System Work.

1.2 RELATED REQUIREMENTS

- .1 Section 25 05 01 - General Requirements.
- .2 Section 01 33 00 – Submittals

1.3 DEFINITIONS

- .1 CDL - Control Description Logic.
- .2 For additional acronyms and definitions refer to Section 25 05 01 - General Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittals, supplemented and modified by requirements of this Section.
- .2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to DCC Representative prior to anticipated date of beginning of training.
 - .1 List name of trainer, and type of visual and audio aids to be used.
 - .2 Show co-ordinated interface with other control system mechanical and electrical training programs.
- .3 Submit reports within one week after completion of training program that training has been satisfactorily completed.

1.5 QUALITY ASSURANCE

- .1 Provide competent instructors thoroughly familiar with aspects of control systems installed in facility.
- .2 DCC Representative reserves right to approve instructors.

1.6 INSTRUCTIONS

- .1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of control systems installed.
- .2 Training to be project-specific.

1.7 TIME FOR TRAINING

- .1 Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15 minute breaks and excluding lunch time).

1.8 TRAINING MATERIALS

- .1 Provide equipment, visual and audio aids, and materials for classroom training.

- .2 Supply manual for each trainee, describing in detail data included in each training program.
 - .1 Review contents of manual in detail to explain aspects of operation and maintenance (O M).

1.9 TRAINING PROGRAM

- .1 To be completed in phases as required by substantial completion
- .2 Phase 1: 2 day program to begin before 30 day test period at time mutually agreeable to Contractor, DCC Representative.
 - .1 Train O M personnel in functional operations and procedures to be employed for system operation.
 - .2 Supplement with on-the-job training during 30 day test period.
 - .3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.
 - .4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
- .3 Operator training and technical certification program to be completed by substantial completion of project.
 - .1 Provide multiple instructors on pre-arranged schedule. Include at least following:
 - .1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.
 - .2 Equipment maintenance training: provide personnel with 1 day training within 2 day period in maintenance of control system equipment, including general equipment layout, trouble shooting and preventive maintenance of control system components, maintenance and calibration of sensors and controls.
 - .3 Programming: Provide 3 DND controls technicians with full training to certify as system technicians/programmers. Training may be conducted on, or off site. Control contractor shall cover all costs of training including registration, materials, accommodations, and meals.

1.10 ADDITIONAL TRAINING

- .1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.11 MONITORING OF TRAINING

- .1 DCC Representative to monitor training program and may modify schedule and content.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 General requirements for building Control Systems that are common to Control Sections.

1.2 RELATED REQUIREMENTS

- .1 Section 01 35 43 - Environmental Procedures
- .2 Section 01 70 12 - Safety Requirements
- .3 Section 01 74 11 – Cleaning
- .4 Section 09 91 00 Painting
- .5 Section 25 05 02 - Shop Drawings, Product Data and Review Process.
- .6 Section 25 05 54 - Identification

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
 - .1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
 - .1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .4 Electrical and Electronic Manufacturers Association (EEMAC).
 - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).

1.4 ACRONYMS AND ABBREVIATIONS

- .1 Acronyms used in control systems:
 - .1 ACI – Automatic Controls and Instrumentation
 - .2 AEL - Average Effectiveness Level.
 - .3 AI - Analog Input.
 - .4 AO - Analog Output.
 - .5 BC(s) - Building Controller(s).
 - .6 BECC - Building Environmental Control Center.
 - .7 CAD - Computer Aided Design.
 - .8 CDL - Control Description Logic.
 - .9 CDS - Control Design Schematic.

- .10 COSV - Change of State or Value.
- .11 CPU - Central Processing Unit.
- .12 DI - Digital Input.
- .13 DO - Digital Output.
- .14 DP - Differential Pressure.
- .15 ECU - Equipment Control Unit.
- .16 HVAC - Heating, Ventilation, Air Conditioning.
- .17 IDE - Interface Device Equipment.
- .18 I/O - Input/Output.
- .19 ISA - Industry Standard Architecture.
- .20 LAN - Local Area Network.
- .21 LCU - Local Control Unit.
- .22 MCU - Master Control Unit.
- .23 NC - Normally Closed.
- .24 NO - Normally Open.
- .25 OS - Operating System.
- .26 O M - Operation and Maintenance.
- .27 PCI - Peripheral Control Interface.
- .28 PID - Proportional, Integral and Derivative.
- .29 RAM - Random Access Memory.
- .30 SP - Static Pressure.
- .31 ROM - Read Only Memory.
- .32 TCU - Terminal Control Unit.
- .33 USB - Universal Serial Bus.
- .34 UPS - Uninterruptible Power Supply.

1.5 DEFINITIONS

- .1 Point: may be logical or physical.
 - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
 - .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and damper actuators.
- .2 Point Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
 - .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25character field for each point identifier.

- .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
- .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
 - .1 AI (analog input).
 - .2 AO (analog output).
 - .3 DI (digital input).
 - .4 DO (digital output).
 - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
 - .1 Printouts: to ANSI/IEEE 260.1.
 - .2 Refer also to Section 25 05 54 - Identification.

1.6 SYSTEM DESCRIPTION

- .1 Control Systems:
 - .1 The existing facility is served by a pneumatically controlled automation system. It is intended that a future project will introduce a fully digital ACI.
 - .2 All new devices installed in this project shall be Direct Digital Control (DDC) capable of stand-alone operation.
 - .3 All new equipment must be capable of responding to all direct commands from, be fully compatible with, fully programmed by, fully read/write capable by, completely integratable to, the existing CFB Borden site wide ACI infrastructure. Delta Controls EnteliWEB, Alerton Controls Ascent Compass, and Johnson Controls Metasys MUI are the three systems that currently have CMS (Central Monitoring Station) connected to the BEMAC VRF at CFB Borden.
- .2 Work covered by sections referred to above consists of fully operational control systems, including, but not limited to, following:
 - .1 Building Controllers.
 - .2 Control devices as listed in I/O point summary tables.
 - .3 Data communications equipment necessary to effect control system data transmission system.
 - .4 Field control devices.
 - .5 Software/Hardware complete with full documentation.
 - .6 Complete operating and maintenance manuals.
 - .7 Training of personnel.
 - .8 Acceptance tests, technical support during commissioning, full documentation.
 - .9 Wiring interface co-ordination of equipment supplied by others.
 - .10 Miscellaneous work as specified in these sections and as indicated.

- .3 Design Requirements:
 - .1 Design and provide conduit and wiring linking elements of system.
 - .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by DCC Representative prior to installation.
 - .3 Location of controllers as reviewed by DCC Representative prior to installation.
 - .4 Provide utility power to control systems as indicated.
 - .5 Metric references: in accordance with CAN/CSA Z234.1.
- .4 Language Operating Requirements:
 - .1 Provide English and French operator selectable access codes.
 - .2 Use non-linguistic symbols for displays on graphic terminals. Other information to be in English and French.
 - .3 Operating system executive: provide primary hardware-to-software interface with associated documentation to be in English and French.
 - .4 System manager software: include in English and French system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
 - .5 Include, in English and French:
 - .1 Input and output commands and messages from operator-initiated functions, field related changes, alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).
 - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English and French at specified OWS and to be able to operate terminal in English and French.
 - .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 25 05 02 - Shop Drawings, Product Data and Review Process.
- .2 Submit for review:
 - .1 Equipment list within 10 days after award of contract.
- .3 Quality Control:
 - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
 - .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
 - .3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 - Shop Drawings, Product Data and Review Process. Label or listing of specified organization is acceptable evidence.

- .4 In lieu of such evidence, submit certificate from testing organization, approved by DCC Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
- .6 Permits and fees: in accordance with general conditions of contract.
- .7 Submit certificate of acceptance from authority having jurisdiction to DCC Representative.

1.8 QUALITY ASSURANCE

- .1 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.
- .2 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide DCC Representative with schedule within 2 weeks after award of Contract.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials in accordance with Section 01 35 43 - Environmental Procedures.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
 - .4 Separate for reuse and recycling and place in designated containers waste in accordance with Section 01 74 11 - Cleaning.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
 - .7 Label location of salvaged material's storage areas and provide barriers and security devices.
 - .8 Ensure emptied containers are sealed and stored safely.
 - .9 Divert unused materials from landfill to recycling facility as approved by DCC Representative.
 - .10 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

- .1 Data Communication Protocol: to ASHRAE STD 135.
- .2 Complete list of equipment and materials to be used on project and forming part of documents by adding manufacturer's name, model number and details of materials, and submit for approval.
- .3 Provide explosion-proof control components in accordance with mechanical drawings.

2.2 ADAPTORS

- .1 Provide adaptors between metric and imperial components.
- .2 Provide explosion-proof adaptors in accordance with mechanical drawings.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

- .1 Installation: to manufacturer's recommendations.

3.2 PAINTING

- .1 Painting: in accordance with Section 09 91 00Painting, supplemented as follows:
 - .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
 - .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
 - .3 Clean and prime exposed hangers, racks, fastenings, and other support components.
 - .4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section 01 35 43 - Environmental Procedures, include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction cleaning.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Certified Wood.
 - .8 Low-emitting materials.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Control Systems.

1.2 RELATED REQUIREMENTS

- .1 01 33 00 – Submittal Procedures
- .2 Section 25 05 01 - General Requirements
- .3 Section 25 01 11 - Start-up, Verification and Commissioning

1.3 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 - General Requirements.

1.4 DESIGN REQUIREMENTS

- .1 Preliminary Design Review: to contain following contractor and systems information.
 - .1 Location of local office.
 - .2 Description and location of installing and servicing technical staff.
 - .3 Location and qualifications of programming design and programming support staff.
 - .4 Names of sub-contractors and site-specific key personnel.
 - .5 Sketch of site-specific system architecture.
 - .6 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
 - .7 Descriptive brochures.
 - .8 Sample CDL and graphics (systems schematics).
 - .9 Response time for each type of command and report.
 - .10 Item-by-item statement of compliance.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures and coordinate with requirements in this Section.
- .2 Submit preliminary design document within 5 working days after contract award, for review by DCC Representative.
- .3 Shop Drawings to consist of 1 hard copy and 1 soft copy of design documents, shop drawings, product data and software.
- .4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- .5 Soft copy to be in Autocad - latest version and Microsoft Word latest version format, structured using menu format for easy loading and retrieval on a personal computer.

1.6 PRELIMINARY SHOP DRAWING REVIEW

- .1 Submit preliminary shop drawings within 20 working days of award of contract and include following:
 - .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
 - .2 Detailed system architecture showing all points associated with each controller including signal levels, pressures, demarcation of new control systems ties into existing control equipment.
 - .3 Spare point capacity of each controller by number and type.
 - .4 Controller locations.
 - .5 Auxiliary control cabinet locations.
 - .6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
 - .7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, valve size, actual Cv, spring range, required torque, actual torque and close off pressure (required and actual).

1.7 DETAILED SHOP DRAWING REVIEW

- .1 Submit detailed shop drawings within 40 working days after award of contract and before start of installation and include following:
 - .1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
 - .2 Wiring diagrams.
 - .3 Piping diagrams and hook-ups.
 - .4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
 - .5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
 - .1 Sensing element type and location.
 - .2 Transmitter type and range.
 - .3 Associated field wiring schematics, schedules and terminations.
 - .4 Complete Point Name Lists.
 - .5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
 - .6 Software and programming details associated with each point.
 - .7 Manufacturer's recommended installation instructions and procedures.
 - .8 Input and output signal levels or pressures where new system ties into existing control equipment.
 - .6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of control systems.

- .7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
- .8 Complete system CDL's including companion English and French language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
- .9 Listing and example of specified reports.
- .10 Listing of time of day schedules.
- .11 Mark up to-scale construction drawing to detail control room showing location of equipment.
- .12 Type and size of memory with statement of spare memory capacity.
- .13 Full description of software programs provided.
- .14 Sample of "Operating Instructions Manual" to be used for training purposes.
- .15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 - Start-up, Verification and Commissioning.

1.8 QUALITY ASSURANCE

- .1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:
 - .1 Undertake functional review of preliminary design documents, resolve inconsistencies.
 - .2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
 - .3 Review interface requirements of materials supplied by others.
 - .4 Review "Sequence of Operations".
- .2 Contractor's programmer to attend meeting.
- .3 DCC Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to DCC Representative.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for final control diagrams and operation and maintenance (O M) manual, for building Control System Work.

1.2 RELATED REQUIREMENTS

- .1 Section 01 78 00 - Closeout Procedures
- .2 Section 25 01 11 - Start-up, Verification and Commissioning
- .3 Section 25 05 01 - General Requirements.
- .4 Section 25 05 02 - Submittals and Review Process

1.3 DEFINITIONS

- .1 BECC - Building Environmental Control Centre.
- .2 For additional acryonyms and definitions refer to Section 25 05 01 - General Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.
- .2 Submit As-built drawings and Operation and Maintenance Manual to DCC Representative in English and French.

1.5 AS-BUILTS

- .1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - Submittals and Review Process and include:
 - .1 Changes to contract documents as well as addenda and contract extras.
 - .2 Changes to interface wiring.
 - .3 Routing of conduit, wiring and control air lines associated with control system installation.
 - .4 Locations of obscure devices to be indicated on drawings.
 - .5 Listing of alarm messages.
 - .6 Panel/circuit breaker number for sources of normal/emergency power.
 - .7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
 - .8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - Start-up, Verification and Commissioning.
 - .9 Basic system design and full documentation on system configuration.
- .2 Submit for final review by DCC Representative.
- .3 Provide before acceptance 4 Hard and 1 soft copy incorporating changes made during final review.

1.6 O M MANUALS

- .1 Custom design O M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
- .2 Provide 2 hard copies and 1 soft copy (electronic copy (CD/DVD)) prior to system or equipment tests
- .3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
- .4 Functional description to include:
 - .1 Functional description of theory of operation.
 - .2 Design philosophy.
 - .3 Specific functions of design philosophy and system.
 - .4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
 - .5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
 - .6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.
- .5 System operation to include:
 - .1 Complete step-by-step procedures for operation of system.
 - .2 Operation of computer peripherals, input and output formats.
 - .3 Emergency, alarm and failure recovery.
 - .4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.
- .6 Software to include:
 - .1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
 - .2 Detailed descriptions of program requirements and capabilities.
 - .3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
 - .4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device
 - .5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
 - .6 Software for each Controller and single section referencing Controller common parameters and functions.

- .7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.
- .8 System configuration document:
 - .1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.
 - .2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.
- .9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Control System Work and nameplates materials, colours and lettering sizes.

1.2 RELATED REQUIREMENTS

- .1 Section 25 05 01 - General Requirements
- .2 Section 01 33 00 – Submittals

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1, The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

1.4 DEFINITIONS

- .1 For acronyms and definitions refer to Section 25 05 01 - General Requirements.

1.5 SYSTEM DESCRIPTION

- .1 Language Operating Requirements: provide identification for control items in English.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittals supplemented and modified by requirements of this Section.
- .2 Submit to DCC Representative for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 Products

2.1 NAMEPLATES FOR PANELS

- .1 Identify by Plastic laminate, 3 mm thick, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.
- .2 Sizes: 25 x 67 mm minimum.
- .3 Lettering: minimum 7 mm high, black.
- .4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

- .1 Identify by plastic encased cards attached by plastic tie.
- .2 Sizes: 50 x 100 mm minimum.
- .3 Lettering: minimum 5 mm high produced from laser printer in black.

- .4 Data to include: point name and point address.
- .5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

- .1 Identify by stick-on labels using point identifier.
- .2 Location: as directed by DCC Representative.
- .3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

- .1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of control systems.
- .2 Sign to read: "Caution: This equipment is under automatic remote control of control systems" as reviewed by DCC Representative's.

2.5 WIRING

- .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
- .2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.
- .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each control panel.

2.6 CONDUIT

- .1 Colour code control system conduit.
- .2 Pre-paint box covers and conduit fittings.
- .3 Conduit Colour Code: White.

Part 3 Execution

3.1 NAMEPLATES AND LABELS

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

- .1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 73 03 - Execution Requirements
- .2 Section 23 05 05 – Installation of Pipework
- .3 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .4 Section 25 05 54 - Identification
- .5 Section 23 07 13 – Duct Insulation
- .6 Section 23 07 15 Thermal Insulation for Piping
- .7 Section 25 08 20 - Warranty and Maintenance

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C2, National Electrical Safety Code.
 - .2 ANSI/NFPA 70, National Electrical Code.
- .2 CSA Group
 - .1 CSA C22.1, Canadian Electrical Code.
 - .2 CAN/CSA-C22.3 No. 7, Underground Systems.
 - .3 CSA C22.2 No. 45.1, Electrical Rigid Metal Conduit.
 - .4 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .5 CSA C22.2 No. 83, Electrical Metallic Tubing.

1.3 SYSTEM DESCRIPTION

- .1 Electrical:
 - .1 Provide power wiring from existing panels to control system field panels. Circuits to be for exclusive use of control equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.
 - .2 Hard wiring between field control devices and control system field panels.
 - .3 Communication wiring between equipment control panels and control system field panels.
 - .4 Modify existing starters to provide for control systems as indicated in I/O Summaries and as indicated.
- .2 Mechanical:
 - .1 Wells and Control Valves shall be supplied by Control Contractor and installed by Mechanical Contractor.
 - .2 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Mechanical Contractor. Costs to be carried by designated trade.

1.4 PERSONNEL QUALIFICATIONS

- .1 Qualified supervisory personnel to:
 - .1 Continuously direct and monitor all work.
 - .2 Attend site meetings.

1.5 EXISTING CONDITIONS

- .1 Cutting and Patching: refer to Section 01 73 03 - Execution Requirements supplemented as specified herein.
- .2 Repair all surfaces damaged during execution of work.
- .3 Turn over to DCC Representative existing materials removed from work not identified for re-use.

Part 2 Products

2.1 PIPING

- .1 Hangers and supports: refer to Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .2 Insulation: refer to Section 23 07 13 – Duct Insulation and 23 07 15 Thermal Insulation for Piping

2.2 SPECIAL SUPPORTS

- .1 Structural grade steel primed and painted after construction and before installation.

2.3 WIRING

- .1 As per requirements of electrical specifications.
- .2 For 70V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.
- .3 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.
- .4 Sizes:
 - .1 120V Power supply: to match or exceed breaker, size #12 minimum.
 - .2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
 - .3 Field wiring to digital device: #18 AWG.
 - .4 Analog input and output: shielded #18 minimum solid copper. Wiring must be continuous without joints.
 - .5 More than 4 conductors: #22 minimum solid copper.
- .5 Terminations:
 - .1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.4 CONDUIT

- .1 As per requirements of electrical specifications.

2.5 WIRING DEVICES, COVER PLATES

- .1 As per requirements of electrical specifications.

2.6 STARTERS, CONTROL DEVICES

- .1 Across-the-line magnetic starters:
 - .1 Enclosures: CSA Type 1, except where otherwise specified.
 - .2 Size, type and rating: to suit motors.
- .2 Starter diagrams:
 - .1 Provide copy of wiring and schematic diagrams - mount one copy in each starter with additional copies for operation and maintenance manual.
- .3 Auxiliary Control Devices:
 - .1 Control transformers: 60 Hz, primary voltage to suit supply, 120 V single phase secondary, VA rating to suit load plus 20% margin.
 - .2 Auxiliary contacts: one "Normally Open" and one "Normally Closed" spare auxiliary contact in addition to maintained auxiliary contacts as indicated.
 - .3 Hand-Off-Automatic switch: heavy duty type, knob lever operator.
 - .4 Double voltage relays: with barrier to separate relay contacts from operating magnet. Operating coil voltage and contact rating as indicated.

2.7 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

- .1 As per requirements of electrical specifications.

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 PIPING

- .1 Hot water heating: refer to drawing specifications.

3.3 SUPPORTS

- .1 Install special supports as required and as indicated.

3.4 ELECTRICAL GENERAL

- .1 Do complete installation in accordance with requirements of:
 - .1 Division 26, this specification.
 - .2 CSA 22.1 Canadian Electrical Code.
 - .3 ANSI/NFPA 70.
 - .4 ANSI C2.
- .2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.
- .3 Do underground installation to CAN/CSA-C22.3 No.7, except where otherwise specified.

- .4 Conform to manufacturer's recommendations for storage, handling and installation.
- .5 Check factory connections and joints. Tighten where necessary to ensure continuity.
- .6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
- .7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.
- .8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.
- .9 Install conduits, and sleeves prior to pouring of concrete.
- .10 Holes through exterior wall and roofs: flash and make weatherproof.
- .11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- .12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.5 CONDUIT SYSTEM

- .1 Minimum conduit size shall be 21mm dia.
- .2 Communication wiring shall be installed in conduit. Where end termination devices is unavailable, conduit shall terminate within 600mm of end device. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fill not to exceed 40%. Design drawings do not show conduit layout.
 - .1 Low voltage control wiring is permitted to be run in communications cable tray. Use cable tray where feasible to reduce conduit runs. All conduit stubs to cable tray must follow TBITS 6.9 and BICSI TDMM installation standards.
- .3 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.
- .4 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from DCC Representative before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.
- .5 Locate conduits at least 150 mm from parallel hot water pipes and at least 50 mm at crossovers.
- .6 Bend conduit so that diameter is reduced by less than 1/10th original diameter.
- .7 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.
- .8 Limit conduit length between pull boxes to less than 30 m.
- .9 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.
- .10 Fastenings and supports for conduits, cables, and equipment:
 - .1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.
 - .2 Provide adequate support for raceways and cables, sloped vertically to equipment.

- .3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from DCC Representative.
- .11 Install polypropylene fish cord in empty conduits for future use.
- .12 Where conduits become blocked, remove and replace blocked sections.
- .13 Pass conduits through structural members only after receipt of DCC Representative's written approval.
- .14 Conduits may be run in flanged portion of structural steel.
- .15 Group conduits wherever possible on suspended or surface channels.
- .16 Pull boxes:
 - .1 Install in inconspicuous but accessible locations.
 - .2 Support boxes independently of connecting conduits.
 - .3 Fill boxes with paper or foam to prevent entry of construction material.
 - .4 Provide correct size of openings. Reducing washers not permitted.
 - .5 Mark location of pull boxes on record drawings.
 - .6 Identify AC power junction boxes, by panel and circuit breaker.
- .17 Install terminal blocks or strips in cabinets for connection to pre-manufactured equipment.
- .18 Install bonding conductor for 120 volt and above in conduit.

3.6 WIRING

- .1 Install multiple wiring in ducts simultaneously.
- .2 Do not pull spliced wiring inside conduits or ducts.
- .3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.
- .4 Tests: use only qualified personnel. Demonstrate that:
 - .1 Circuits are continuous, free from shorts, unspecified grounds.
 - .2 Resistance to ground of all circuits is greater than 50 Megohms.
- .5 Provide DCC Representative with test results showing locations, circuits, results of tests.
- .6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.
- .7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.
- .8 Do not allow wiring to come into direct physical contact with compression screw.
- .9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.7 WIRING DEVICES, COVER PLATES

- .1 Receptacles:
 - .1 Install vertically in gang type outlet box when more than one receptacle is required in one location.

- .2 Cover plates:
 - .1 Install suitable common cover plate where wiring devices are grouped.
 - .2 Use flush type cover plates only on flush type outlet boxes.

3.8 STARTERS, CONTROL DEVICES

- .1 Install and make power and control connections as indicated.
- .2 Install correct over-current devices.
- .3 Identify each wire, terminal for external connections with permanent number marking identical to diagram.
- .4 Performance Verification:
 - .1 Operate switches and controls to verify functioning.
 - .2 Perform start and stop sequences of contactors and relays.
 - .3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.9 GROUNDING

- .1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.
- .2 Install separate grounding conductors in conduit within building.
- .3 Install ground wire in all PVC ducts and in tunnel conduit systems.
- .4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.10 TESTS

- .1 General:
 - .1 Perform following tests in addition to tests specified Section 25 08 20 - Warranty and Maintenance.
 - .2 Give 14 days written notice of intention to test.
 - .3 Conduct in presence of DCC Representative and authority having jurisdiction.
 - .4 Conceal work only after tests satisfactorily completed.
 - .5 Report results of tests to DCC Representative in writing.
 - .6 Preliminary tests:
 - .1 Conduct as directed to verify compliance with specified requirements.
 - .2 Make needed changes, adjustments, replacements.
 - .3 Insulation resistance tests:
 - .1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.
 - .2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of DCC Representative and authority having jurisdiction.

3.11 IDENTIFICATION

- .1 Refer to Section 25 05 54 - Identification.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Control Systems.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittals
- .2 Section 01 78 00 - Closeout Submittals
- .3 Section 25 05 01 - General Requirements

1.3 REFERENCES.

- .1 Canadian Standards Association (CSA International).
 - .1 CSA Z204, Guidelines for Managing Indoor Air Quality in Office Buildings.

1.4 DEFINITIONS

- .1 BC(s) - Building Controller(s).
- .2
- .3 For additional acronyms and definitions refer to Section 25 05 01 - General Requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittals.
- .2 Submit detailed preventative maintenance schedule for system components to DCC Representative.
- .3 Submit detailed inspection reports to DCC Representative.
- .4 Submit dated, maintenance task lists to DCC Representative and include the following sensor and output point detail, as proof of system verification:
 - .1 Point name and location.
 - .2 Device type and range.
 - .3 Measured value.
 - .4 System displayed value.
 - .5 Calibration detail
 - .6 Indication if adjustment required,
 - .7 Other action taken or recommended.
- .5 Submit network analysis report showing results with detailed recommendations to correct problems found.
- .6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Maintain records and logs of each maintenance task on site.

- .2 Organize cumulative records for each major component and control system chronologically.
- .3 Submit records to DCC Representative, after inspection indicating that planned and systematic maintenance have been accomplished.
- .7 Revise and submit to DCC Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to control systems made during warranty period.

1.6 MAINTENANCE SERVICE DURING WARRANTY PERIOD

- .1 Provide services, materials, and equipment to maintain control systems for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.
- .2 Emergency Service Calls:
 - .1 Qualified control personnel to be available during warranty period to provide service.
 - .2 Furnish DCC Representative with telephone number where service personnel may be reached at any time.
 - .3 Service personnel to be on site ready to service control systems within 2 hours after receiving request for service.
 - .4 Perform Work continuously until control systems restored to reliable operating condition.
- .3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of control systems based on original design conditions and as recommended by manufacturer.
- .4 Work requests: record each service call request, when received separately on approved form and include:
 - .1 Serial number identifying component involved.
 - .2 Location, date and time call received.
 - .3 Nature of trouble.
 - .4 Names of personnel assigned.
 - .5 Instructions of work to be done.
 - .6 Amount and nature of materials used.
 - .7 Time and date work started.
 - .8 Time and date of completion.
- .5 Provide system modifications in writing.
 - .1 No system modification, including operating parameters and control settings, to be made without prior written approval of DCC Representative.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for building automation controllers including:
 - .1 Master Control Unit (MCU).
 - .2 Local Control Unit (LCU).
 - .3 Equipment Control Unit (ECU).
 - .4 Terminal Control Unit (TCU).

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittals
- .2 Section 25 05 01 - General Requirements
- .3 Section 25 05 02 - Submittals and Review Process
- .4 Section 25 05 03 - Project Record Documents
- .5 Section 25 90 01 - Site Requirements, Applications and System Sequences of Operation

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE, Applications Handbook, SI Edition.
- .2 Canadian Standards Association (CSA International).
 - .1 C22.2 No.205, Signal Equipment.
- .3 Institute of Electrical and Electronics Engineers (IEEE).
 - .1 IEEE C37.90.1, Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

1.4 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 - General Requirements.

1.5 DESCRIPTION

- .1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.
 - .1 Provide sufficient controllers to meet intents and requirements of this section.
 - .2 Controller quantity, and point contents to be approved by DCC Representative at time of preliminary design review.
- .2 Controllers: stand-alone intelligent Control Units.
 - .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

- .2 Incorporate communication interface ports for communication to exchange information with other Controllers.
- .3 Incorporate network interface port for communication with future BEMAC VRF Network for interconnection with CMS
- .4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).
 - .1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).
- .3 To include:
 - .1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.
 - .2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.
 - .3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.
 - .4 Control of systems as described in sequence of operations.
 - .5 Execution of optimization routines as listed in this section.
- .4 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.
- .5 Field Termination and Interface Devices:
 - .1 To: CSA C22.2 No.205.
 - .2 Electronically interface sensors and control devices to processor unit.
 - .3 Include, but not be limited to, following:
 - .1 Programmed firmware or logic circuits to meet functional and technical requirements.
 - .2 Power supplies for operation of logics devices and associated field equipment.
 - .3 Lockable wall cabinet.
 - .4 Required communications equipment and wiring (if remote units).
 - .5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.
 - .6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.
 - .7 Wiring terminations: use conveniently located screw type or spade lug terminals.
 - .4 AI interface equipment to:
 - .1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.
 - .2 Provide for following input signal types and ranges:
 - .1 4 - 20 mA;
 - .2 0 - 10 V DC;
 - .3 100/1000 ohm RTD input;
 - .3 Meet IEEE C37.90.1 surge withstand capability.

- .4 Have common mode signal rejection greater than 60 dB to 60 Hz.
- .5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.
- .5 AO interface equipment:
 - .1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.
 - .2 Provide for following output signal types and ranges:
 - .1 4 - 20 mA.
 - .2 0 - 10 V DC.
 - .3 Meet IEEE C37.90.1 surge withstand capability.
- .6 DI interface equipment:
 - .1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.
 - .2 Meet IEEE C37.90.1 surge withstand capability.
 - .3 Accept pulsed inputs up to 2 kHz.
- .7 DO interface equipment:
 - .1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.
 - .2 Switch up to 5 amps at 220 V AC using optional interface relay.
- .6 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20% to 90% non-condensing RH.
- .7 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.
 - .1 Provide for conduit entrance from top, bottom or sides of panel.
 - .2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.
 - .3 Mounting details as approved by DCC Representative for ceiling mounting.
- .8 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.
- .9 Provide surge and low voltage protection for interconnecting wiring connections.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittals and Section 25 05 02 - Submittals and Review Process.
 - .1 Submit product data sheets for each product item proposed for this project.

1.7 MAINTENANCE

- .1 Provide manufacturers recommended maintenance procedures for insertion in Section 25 05 03 - Project Record Documents.

Part 2 Products

2.1 MASTER CONTROL UNIT (MCU)

- .1 General: primary function of MCU is to provide co-ordination and supervision of subordinate devices in execution of optimization routines such as demand limiting or enthalpy control.
- .2 Include high speed communication LAN Port for Peer to Peer communications with future OWS(s) and other MCU level devices.
- .3 MCU local I/O capacity as follows:
 - .1 MCU I/O points as allocated in I/O Summary Table.
 - .2 LCUs may be added to support system functions.
- .4 Central Processing Unit (CPU).
 - .1 Processor to consist of minimum 16 bit microprocessor capable of supporting software to meet specified requirements.
 - .2 CPU idle time to be more than 30% when system configured to maximum input and output with worst case program use.
 - .3 Minimum addressable memory to be at manufacturer's discretion but to support at least performance and technical specifications to include but not limited to:
 - .1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.
 - .2 Battery backed (72 hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS.
 - .4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.
- .5 Local Operator Terminal (OT): Provide OT for each MCU unless otherwise specified in mechanical drawings.
 - .1 Mount access/display panel in MCU or in suitable enclosure beside MCU as approved by DCC Representative.
 - .2 Support operator's terminal for local command entry, instantaneous and historical data display, programs, additions and modifications.
 - .3 Display simultaneously minimum of 16 point identifiers to allow operator to view single screen dynamic displays depicting entire mechanical systems. Point identifiers to be in English and French.
 - .4 Functions to include, but not be limited to, following:
 - .1 Start and stop points.
 - .2 Modify setpoints.
 - .3 Modify PID loop parameters.
 - .4 Override PID control.

- .5 Change time/date.
- .6 Add/modify/start/stop weekly scheduling.
- .7 Add/modify setpoint weekly scheduling.
- .8 Enter temporary override schedules.
- .9 Define holiday schedules.
- .10 View analog limits.
- .11 Enter/modify analog warning limits.
- .12 Enter/modify analog alarm limits.
- .13 Enter/modify analog differentials.
- .5 Provide access to real and calculated points in controller to which it is connected or to other controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and other controller in network.
- .6 Operator access to OTs: same as OWS user password and password changes to automatically be downloaded to controllers on network.
- .7 Provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.
- .8 Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS's for access of points at OT to eliminate cross-reference or look-up tables.

2.2 LOCAL CONTROL UNIT (LCU)

- .1 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.
- .2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.
- .3 Points integral to one Building System to be resident on only one controller.
- .4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:
 - .1 Include minimum 2 interface ports for connection of local computer terminal.
 - .2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.
 - .3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.
 - .4 Include power supplies for operation of LCU and associated field equipment.
 - .5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
 - .6 Provide conveniently located screw type or spade lug terminals for field wiring.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

- .1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

- .1 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

2.4 SOFTWARE

- .1 General.
 - .1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.
 - .2 Include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.
 - .3 Include initial programming of Controllers, for entire system.
- .2 Program and data storage.
 - .1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.
 - .2 Maintain CDL and operating data including setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.
 - .3 Provide backup copy of system programming and related database to DCC Representative upon acceptance of Final Commissioning.
- .3 Programming languages.
 - .1 Program Control Description Logic software (CDL) using English and French like or graphical, high level, general control language.
 - .2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed unless approved by DCC Representative.
- .4 Operator Terminal interface.
 - .1 Operating and control functions include:
 - .1 Multi-level password access protection to allow user/manager to limit workstation control. All levels of passwords to be provided to DCC Representative at time of commissioning.
 - .2 Alarm management: processing and messages.
 - .3 Operator commands.
 - .4 Reports.
 - .5 Displays.
 - .6 Point identification.
- .5 Pseudo or calculated points.
 - .1 Software to provide access to value or status in controller or other networked controller in order to define and calculate pseudo point. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.
 - .2 Inputs and outputs for process: include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to number of other processes (e.g. cascading).
- .6 Control Description Logic (CDL):

- .1 Capable of generating on-line project-specific CDLs which are software based, programmed into RAM or EEPROM and backed up to OWS. DCC Representative must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.
- .2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (e.g. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS and BC(s) to tune control loops.
- .3 Perform changes to CDL on-line.
- .4 Control logic to have access to values or status of points available to controller including global or common values, allowing cascading or inter-locking control.
- .5 Energy optimization routines including enthalpy control, supply temperature reset, to be LCU or MCU resident functions and form part of CDL.
- .6 MCU to be able to perform following pre-tested control algorithms:
 - .1 Two position control.
 - .2 Proportional Integral and Derivative (PID) control.
- .7 Control software to provide ability to define time between successive starts for each piece of equipment to reduce cycling of motors.
- .8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
- .9 Power Fail Restart: upon detection of power failure system to verify availability of Emergency Power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under Emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.
- .7 Event and Alarm management: use management by exception concept for Alarm Reporting. This is system wide requirement. This approach will insure that only principal alarms are reported to the future OWS. Events which occur as direct result of primary event to be suppressed by system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. Exception is, when air handler which is supposed to stop or start fails to do so under event condition.
- .8 Energy management programs: include specific summarizing reports, with date stamp indicating sensor details which activated and or terminated feature.
 - .1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:
 - .1 Time of day scheduling.
 - .2 Calendar based scheduling.
 - .3 Holiday scheduling.
 - .4 Temporary schedule overrides.
 - .5 Optimal start stop.

- .6 Night setback control.
- .7 Enthalpy (economizer) switchover.
- .8 Peak demand limiting.
- .9 Temperature compensated load rolling.
- .10 Fan speed/flow rate control.
- .11 Cold deck reset.
- .12 Hot deck reset.
- .13 Hot water reset.
- .14 Night purge.
- .2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.
- .3 Apply programs to equipment and systems as specified or requested by the DCC Representative.
- .9 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.
 - .1 MCUs to accumulate and store automatically run-time for binary input and output points.
 - .2 MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.
 - .3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.
 - .4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.
 - .5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWh, litres, tonnes, etc.).
 - .6 Store event totalization records with minimum of 9,999,999 events before reset.
 - .7 User to be able to define warning limit and generate user-specified messages when limit reached.

2.5 LEVELS OF ADDRESS

- .1 Upon operator's request, control systems shall be capable of presenting status of any single 'point', 'system' or point group, entire 'area' as selected by operator.
 - .1 Display analog values digitally to 1 place of decimals with negative sign as required.
 - .2 Update displayed analog values and status when new values received.
 - .3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.
 - .4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

Part 3 Execution

3.1 LOCATION

- .1 Location of MCU and LCU to be grouped in one secure conditioned location such as Mechanical room or Electrical room. MCU and LCU are not to be located above ceilings. Final locations to be approved by DCC Representative ..

3.2 INSTALLATION

- .1 Install Controllers in secure locking enclosures as directed by DCC Representative.
- .2 Provide necessary power from UPS.
- .3 Install tamper locks on breakers of circuit breaker panel.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Control devices integral to the Building Control Systems: transmitters, sensors, controls, switches, valves, valve actuators, and low voltage current transformers.

1.2 Related Sections:

- .1 Section 01 73 03 - Execution Requirements
- .2 Section 25 01 11 - Start-up, Verification and Commissioning
- .3 Section 25 05 01 - General Requirements
- .4 Section 25 05 02 - Submittals and Review Process
- .5 Section 25 05 54 - Identification
- .6 Electrical specifications.

1.3 REFERENCES

- .1 National Electrical Manufacturer's Association (NEMA).
 - .1 NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 DEFINITIONS

- .1 Acronyms and Definitions: refer to Section 25 05 01 - General Requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - Submittals and Review Process.
- .2 Pre-Installation Tests.
 - .1 Submit samples at random from equipment shipped, as requested by DCC Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.6 EXISTING CONDITIONS

- .1 Cutting and Patching: in accordance with Section 01 73 03 - Execution Requirements supplemented as specified herein.
- .2 Repair surfaces damaged during execution of Work.
- .3 Turn over to DCC Representative existing materials removed from Work not identified for re-use.

Part 2 Products

2.1 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 **Provide explosion-proof control devices in accordance with requirements specified in Division 26 and Hazardous zones as defined on Electrical Drawings.**
- .3 External trim materials to be corrosion resistant. Internal parts to be assembled in finished assembly.
- .4 Operating conditions: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.
- .5 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .6 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.
- .7 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .8 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.
- .9 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.
- .10 Range: including temperature and pressure, as indicated in Sequence of Operations indicated on drawings

2.2 TEMPERATURE SENSORS

- .1 Room temperature sensors and display wall modules.
 - .1 Temperature sensing and display wall module.
 - .1 LCD display to show space temperature and temperature setpoint.
 - .2 Buttons for occupant selection of temperature setpoint and occupied/unoccupied mode.
 - .3 Jack connection for plugging in laptop personal computer for access to zone bus.
 - .4 Integral thermistor sensing element 10,000 ohm at 24 degrees.
 - .5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.
 - .6 Stability 0.02 degrees C drift per year.
 - .7 Separate mounting base for ease of installation.
 - .2 Outdoor air temperature sensors:
 - .1 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in NEMA 4 enclosure.

2.3 TEMPERATURE TRANSMITTERS

- .1 Requirements:
 - .1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.

- .2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.
- .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .4 Input and output short circuit and open circuit protection.
- .5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.
- .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.
- .7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
- .8 Integral zero and span adjustments.
- .9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50 degrees C.
- .10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.
- .11 Transmitter ranges: select narrowest range to suit application from following:
 - .1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.
 - .2 0 to 100 degrees C, plus or minus 0.5 degrees C.
 - .3 0 to 50 degrees C, plus or minus 0.25 degrees C.
 - .4 0 to 25 degrees C, plus or minus 0.1 degrees C.
 - .5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.4 HUMIDITY SENSORS

- .1 Outdoor Humidity Requirements:
 - .1 Range: 0 - 100% RH minimum.
 - .2 Operating temperature range: -40 - 50 degrees C.
 - .3 Absolute accuracy: plus or minus 2%.
 - .4 Temperature coefficient: plus or minus 0.03%RH/ degrees C over 0 to 50 degrees C.
 - .5 Must be unaffected by condensation or 100% saturation.
 - .6 No routine maintenance or calibration is required.

2.5 HUMIDITY TRANSMITTERS

- .1 Requirements:
 - .1 Input signal: from RH sensor.
 - .2 Output signal: 4 - 20 mA onto 500 ohm maximum load.
 - .3 Input and output short circuit and open circuit protection.
 - .4 Output variations: not to exceed 0.2% of full scale output for supply voltage variations of plus or minus 10%.
 - .5 Output linearity error: plus or minus 1.0% maximum of full scale output.
 - .6 Integral zero and span adjustment.
 - .7 Temperature effect: plus or minus 1.0% full scale/ 6 months.
 - .8 Long term output drift: not to exceed 0.25% of full scale output/ 6 months.

2.6 HAZARDOUS GAS ALARMS

- .1 Controller

- .1 Multi-channel alarm and display controller suitable for monitoring and alarm of hazardous gases.
- .2 Integral programmable key-pad and PC interface capability.
- .3 Input ports accepting up to four (4) gas sensors
- .4 24 VDC power input and RS-485 communication cabling.
- .5 NEAM 4X enclosure, suitable for operation in -20 to 50 ° C space conditions, 5-95% RH.
- .6 Individual system status pilot light
- .7 LCD to identify;
 - .1 Sensor indication
 - .2 Gas type
 - .3 Gas concentration
 - .4 Alarm Status
- .8 Audible alarm
- .9 120V/1Ø main power, integral low voltage transformer
- .10 Programmable sensor set-point. Project specific parameters;
 - .1 15% LEL off
 - .2 20% LEL on
 - .3 35% LEL alarm
- .2 Detector
 - .1 Explosion proof, digital display indicating gas concentration, relay status, peak daily reading.
 - .2 Aluminum housing, CSA C22.2 certified. Nominal 24VDC, 0.3 A max.
 - .3 RS-485 communication to compatible controller, integral clock.
 - .4 Suitable for detection of;
 - .1 Methyl Ethyl Ketone
 - .2 Isopropyl Alcohol
- .3 Audible/Visual Alarm
 - .1 Combination audible/visual alarm strobe.
 - .2 ABS plastic housing with low profile color dome. (red)
 - .3 18-30 VDC, 0.68 amps, NEMA 4X housing.
 - .4 Flash operation: 60/minute @ 0.7 joules
 - .5 Audible alarm; Minimum 90 db @ 1m.
- .4 Acceptable Manufacturer's;
 - .1 Quadrosense Environmental Limited (QEL)
 - .2 Armstrong Monitoring
 - .3 Ornicom

2.7 STATIC PRESSURE SENSORS

- .1 Requirements:
 - .1 Multipoint element with self-averaging manifold.
 - .1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).

- .2 Accuracy: plus or minus 1% of actual duct static pressure.

2.8 ELECTRONIC CONTROL DAMPER ACTUATORS

- .1 Direct mount proportional type as indicated.
- .2 Spring return for “fail-safe” in Normally Open or Normally Closed position as indicated.
- .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
- .4 Power requirements: 5 VA maximum at 24 V AC.
- .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.

2.9 STATIC PRESSURE TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
 - .2 Calibrated span: not to exceed 150% of duct static pressure at maximum flow.
 - .3 Accuracy: 0.4% of span.
 - .4 Repeatability: within 0.5% of output.
 - .5 Linearity: within 1.5% of span.
 - .6 Deadband or hysteresis: 0.1% of span.
 - .7 External exposed zero and span adjustment.
 - .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.10 ELECTROMECHANICAL RELAYS

- .1 Requirements:
 - .1 Double voltage, DPDT, plug-in type with termination base.
 - .2 Coils: rated for 24V DC. Other voltage: provide transformer.
 - .3 Contacts: rated at 5 amps at 120 V AC.
 - .4 Relay to have visual status indication.

2.11 SOLID STATE RELAYS

- .1 General:
 - .1 Relays to be socket or rail mounted.
 - .2 Relays to have LED Indicator
 - .3 Input and output Barrier Strips to accept 14 to 28 AWG wire.
 - .4 Operating temperature range to be -20 degrees C to 70 degrees C.
 - .5 Relays to be CSA Certified.
 - .6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.
 - .7 Operational frequency range, 45 to 65 HZ.
- .2 Input:
 - .1 Control voltage, 3 to 32 VDC.
 - .2 Drop out voltage, 1.2 VDC.

.3 Maximum input current to match AO (Analog Output) board.

.3 Output.

.1 AC or DC Output Model to suit application.

2.12 CURRENT TRANSDUCERS

.1 Requirements:

.2 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:

.1 4-20 mA DC.

.2 0-1 volt DC.

.3 0-10 volts DC.

.4 0-20 volts DC.

.3 Frequency insensitive from 10 - 80 hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

2.13 CURRENT SENSING RELAYS

.1 Requirements:

.1 Suitable to detect belt loss or motor failure.

.2 Trip point adjustment, output status LED.

.3 Split core for easy mounting.

.4 Induced sensor power.

.5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.

.6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.

.7 Adjustable latch level.

2.14 PANELS

.1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by DCC Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.15 WIRING

.1 In accordance with electrical specifications.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:

- .1 Field wiring to digital device: #18AWG.
- .2 Analog input and output: shielded #18 minimum solid copper.

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .3 Temperature transmitters, humidity transmitters controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.
- .4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
- .5 Fire stopping: provide space for fire stopping in accordance with Section 01 73 03 - Execution Requirements. Maintain fire rating integrity.
- .6 Electrical:
 - .1 Complete installation in accordance with electrical specifications.
 - .2 Modify existing starters to provide for control systems as indicated.
 - .3 Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by DCC Representative before beginning Work.
 - .4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
 - .5 Install communication wiring in conduit.
 - .1 Provide complete conduit system to link Building Controllers and field panels.
 - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
 - .3 Maximum conduit fill not to exceed 40%.
 - .4 Design drawings do not show conduit layout.
 - .6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. DCC Representative to review before starting Work.

3.2 TEMPERATURE AND HUMIDITY SENSORS

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.
- .3 Outdoor installation:
 - .1 Protect from solar radiation and wind effects by non-corroding shields.
 - .2 Install in NEMA 4 enclosures.

- .4 Duct installations:
 - .1 Do not mount in dead air space.
 - .2 Locate within sensor vibration and velocity limits.
 - .3 Securely mount extended surface sensor used to sense average temperature.
 - .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
 - .5 Support sensor element separately from coils, filter racks.
- .5 Averaging duct type temperature sensors.
 - .1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
 - .2 Wire multiple sensors in series for low temperature protection applications.
 - .3 Wire multiple sensors separately for temperature measurement.
 - .4 Use software averaging algorithm to derive overall average for control purposes.

3.3 PANELS

- .1 Arrange for conduit and tubing entry from top, bottom or either side.
- .2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.
- .3 Identify wiring and conduit clearly.

3.4 IDENTIFICATION

- .1 Identify field devices in accordance with Section 25 05 54 - Identification.

3.5 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - Start-up, Verification and Commissioning.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations, Includes Errata (2021).
 - .2 CAN3 C235-83 R2015, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .3 CSA C22.2 No. 174-18 National Standard of Canada, Cables and cable glands for use in hazardous locations.
 - .4 CAN/CSA C22.2 No.18.3-12 (R2022), Conduit, Tubing, and Cable (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
 - .5 CAN/CSA C22.2 No.18.4-15 (R2019), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National standard, with UL 2239)
 - .6 CAN/CSA C22.2 No.65-18, Wire connectors (Trinational standard with NMX-J-543-ANCE and UL 486A-486B).
- .2 Ontario Electrical Safety Code, 28th Edition, 2021, includes CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition) and Ontario Amendments to that Code.
- .3 ANSI/ASHRAE/IES Standard 90.1-2022, Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings.
- .4 Electrical and Electronic Manufacturer's Association of Canada (EEMAC); EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .5 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .6 Health Canada/Workplace Hazardous Materials Information Systems (WHMIS); Material Safety Data Sheets (MSDS)
- .7 National Building Code of Canada 2020 (NBC)
- .8 Underwriter's Laboratories of Canada (ULC)
- .9 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122. Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

1.3 RELATED SECTIONS

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Shop Drawings Product Data and Samples.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for lighting, power and systems components and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review single line electrical diagrams in glazed frame and locate as indicated.
 - .1 Electrical distribution system in main electrical room.
 - .2 Electrical power generation and distribution systems in power plant rooms.
- .4 Submit for review fire alarm riser diagram, plan and zoning of building, plastic laminate type, at fire alarm control panel and annunciator.
- .5 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 If changes are required, notify DCC Representative of these changes before they are made.
- .6 Certificates
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to DCC Representative.
- .7 Manufacturer's Field Reports: submit to DCC Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .8 Record Drawings are to be submitted in AutoCAD format.

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 lighting, power, and

systems components for incorporation into manual.

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material Delivery Schedule: provide DCC Representative with schedule within 2 weeks after award of project.
- .3 Construction Waste Management and Disposal: separate waste materials for reuse and recycling.

1.7 CONSTRUCTION / INTERFERENCE DRAWINGS

- .1 Prepare construction drawings showing sleeves and openings for passage through floor structure and all insert sizes and locations.
- .2 Prepare composite construction drawings, fully dimensioned, in metric, of cable, conduit, bus duct, shafts, mechanical and electrical equipment rooms, including switchgear rooms, ceiling spaces and all other critical locations to avoid conflicts. Base equipment drawings upon shop drawings and include, but do not necessarily limit to, all details pertaining to clearances, access, sleeves, electrical connections, location and elevation of pipes, ducts, conduits, etc.
- .3 Prepare a complete set of drawings showing all conduit runs and wiring using the information provided in riser diagrams, circuit numbers on floor plans, relevant details, specifications and with reference to drawings of other systems.
- .4 Prepare all sections and elevations as part of the construction drawings to illustrate complete coordination and compliance with all applicable rules for this project.
- .5 Submit a schedule of construction drawings no later than three weeks after the award, indicating the anticipated date when the drawings will be submitted for review by the DCC Representative.

- .6 Start preparing the construction drawings immediately on award to ensure that all installations are properly coordinated to the satisfaction of the DCC Representative.

1.8 RECORD DRAWINGS

- .1 Show the following on the record (as-built) drawings:
 - .2 All changes to work made during construction and ensure changes are made on floor plans, and riser diagrams; etc., as applicable.
 - .3 All conduit and wiring and all deviation from circuit numbers shown on the technical documents.
 - .4 For the sake of clarity, produce separate lighting, power, communications, fire alarm and security drawings and show all conduit and wiring.
 - .5 Revise and/or draw new riser and connection diagrams as necessary.
 - .6 Revise motor control schedules, motor control centre elevations and schematic as necessary.
 - .7 Record drawings shall comprise of clearly and neatly marked up prints and other drawings as required by the above-mentioned requirements.

1.9 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.
- .7 All instructions are to be bilingual (English and French)
- .8 All instructions are to be submitted in accordance to 017800 Closeout Submittals.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for each language.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.3 HAZARDOUS MARKINGS

- .1 Electrical equipment installed in hazardous locations shall have markings that are suitable for the Zone in which the equipment is installed.
- .2 UL and C-UL hazardous areas Certification for North America

Division system sample marking



Zone system sample marking

ZONE MARKINGS



2.4 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Electrical equipment for use in hazardous locations shall be suitable for the specific explosive atmosphere that will be present.
- .3 Equipment in hazardous locations shall be rated to be installed in Zone 1 or Zone 2 locations and shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

2.5 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction, and DCC Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

2.6 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.7 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black matt white finish face, white core, lettering accurately aligned and engraved into core.
 - .2 Standard nameplate sizes are as indicated below, but unless there are space restrictions, the minimum size of nameplate shall be Size 6 and the minimum size of letters shall be 6 mm.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters

Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 P-touch labels shall be black letters and numbers on white background unless specified otherwise.
- .4 Wording on nameplates and labels to be approved by DCC Representative prior to manufacture.
- .5 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Identify at least the following equipment with nameplates appropriate to the size of the equipment:
 - .1 Switchboards: identify in accordance with drawings and indicate voltage, phases, current capacity, short-circuit rating and system (i.e. utility power, emergency power, data power, UPS, etc.).
 - .2 Transformers: identify in accordance with drawings and indicate primary and secondary voltages and winding configurations, capacity and system.
 - .3 Panels: identify in accordance with drawings and indicate voltage, phases, current capacity, short-circuit rating, power source (fed from...) and system. Provide also typed panel directories inside the panels.
 - .4 Motor control centres: identify in accordance with drawings and indicate voltage, phases, current capacity, short circuit rating, power source and system. Also identify individually all the starters and disconnects in the motor control centres.
 - .5 Starters, contactors, disconnect switches: identify in accordance with the drawings and indicate voltage, phases, current capacity, short circuit rating, power source, system and equipment controlled.
 - .6 Terminal cabinets and pullboxes: for power system equipment, indicate system, voltage, power source and load. For communication/ data/ security system equipment, indicate system and source. Also, indicate terminal cabinet and pullbox numbers on the labels in accordance with the system developed by the DCC Representative.
 - .7 All miscellaneous electrical equipment: identify in accordance with drawings to clearly indicate function and system data.
- .8 Identify at least the following equipment with labels of size appropriate to the equipment:
 - .1 Receptacles: indicate circuit number. Where there is only one receptacle on the circuit indicate this also by using the abbreviation "DED" with the circuit number. P-touch labels shall be black letters and numbers on white background at receptacles for all systems except for "unclassified data power" the P-touch labels shall be black letters and numbers on yellow background.
 - .2 Switches: indicate circuit number. Also indicate the area served where the switch is remotely located and/or is in a group of switches.

- .3 Communication and security outlets: identify all communication and security outlets including at least the following:
 - .1 Data - secure/ open outlets.
 - .2 CCTV camera outlets.
 - .3 Cable TV etc. outlets.
 - .4 Security system outlets.
 - .5 Antenna systems outlets.
 - .6 Satellite TV outlets.
- .9 Equipment numbering shall match actual building room numbering system which may be different from room numbering shown on drawings.

2.8 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.9 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables. For boxes, identify the cover as well as inside each box.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 10 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
HVAC	White	
Other Security Systems	Red	Yellow

2.10 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and at least two coats of finish enamel.
 - .1 Indoor distribution equipment: "light gray" to EEMAC 2Y-1-195.
 - .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting

2.11 INSERTS

- .1 Supply and deliver inserts, anchors, bolts, sleeves, ferrules and other items to be built into the work of other divisions, complete with the necessary templates, instructions and assistance for locating and installing.

2.12 ACCESSORIES

- .1 Where not specifically indicated, provide standard accessory items or materials such as equipment supports, brackets, channels, protection, etc., to make a complete and satisfactory installation.

2.13 PLYWOOD MOUNTING BOARDS

- .1 Surface mounted power distribution equipment shall be mounted on plywood backboards 20 mm thick, G1S with the good side out. Paint with two coats of intumescent paint and comply with pertinent Code requirements.
- .2 Also provide plywood backboards for communications and security equipment finished as described above. Communication equipment to include but security, data, telephone, voice and TV systems.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 For suspended ceiling installations, support luminaires from building structure, independent of ceiling.

3.3 HAZARDOUS LOCATIONS

- 1. Do complete installations in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- 2. Where walls, partitions, floors, or ceilings are used to form hazard-free rooms or sections, they shall be of substantial construction; built of or lined with non-combustible material; and such that the rooms or sections will remain free from hazards.
- 3. Where a non-hazardous location within a building communicates with a Zone 2 location or an explosive dust atmosphere, the locations shall be separated by close-fitting, self-closing fire

doors.

4. Communication from a Zone 1 location shall be a Zone 2 location unless ventilation and safeguards from ventilation failure are provided.

3.4 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety. Take precautions to protect personnel on the job site from injury due to live equipment and circuits.
- .2 Shield and clearly mark live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.
- .4 Protect all finished and unfinished work of this and other divisions from damage due to carrying out of the work.
- .5 Keep equipment dry and clean at all times.
- .6 Cover openings in equipment and materials.
- .7 Be responsible for and make good any damage caused directly or indirectly to walls, floors, ceilings, woodwork, brickwork, finishes, etc. Store switchgear, transformers and sensitive electrical equipment in a dry heated location and protect from dust.

3.5 COORDINATION

- .1 Cooperate and coordinate with the DCC Representative all work related to this work.
- .2 Coordinate with other Contractors on site.
- .3 Locate equipment in such to maximize usable space. Install neatly and close to the building structure all raceways, fittings, pull boxes junction boxes, wiring and cables which are to be concealed, in order that the necessary furring can be kept as small as possible.
- .4 Review relevant shop drawings and product data of other divisions where they affect the work of this section, prior to commencing the work.

3.6 FIREPROOFING

- .1 Where cables or conduits pass through floors and fire rated and non-fire-rated walls, pack space between wiring and sleeve full of materials specified in Section 07 84 00 - Firestopping, and seal with caulking compound.

3.7 SEALING IN HAZARDOUS LOCATIONS

- .1 Seal conduit, boxes, and fittings in hazardous Zone 1 or Zone 2 locations in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

3.8 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.9 CONDUIT AND CABLE INSTALLATION

- .1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

- .2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.
- .3 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 100 mm
- .4 Provide core drilling through concrete, sized for free passage of conduit.
- .5 Provide radio detection scan at each floor slab core drill locations.
- .6 Arrange for holes through exterior walls and roof to be flashed and made weatherproof.
- .7 Install conduits and boxes as per these specifications.
- .8 Provide fire stop as per 3.3 Fireproofing.

3.10 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.11 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm for non-barrier free installation, 1050 mm for barrier free access installations.
 - .2 Wall receptacles:
 - .1 General: 400 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1100 mm.
 - .3 Panelboards: 1800mm to the top, as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 400 mm.
 - .5 Fire alarm devices to latest CAN/ULC S524.
 - .6 Fire alarm bells/horns/strobes: 2100 mm.
 - .7 Television outlets: 400 mm.
 - .8 Wall mounted speakers: 2100 mm.

- .9 Clocks: 2100 mm.
- .10 Door bell pushbuttons: 1200 mm.
- .11 Barrier free washroom buttons: 1050 mm.
- .12 Emergency Lights: Not less than 2m above finished floor where practical.
- .13 Exit Signs: 2200 mm
- .14 Light Fixtures: Where suspended, to 2750 mm.

3.12 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
 - .1 required values and settings.

3.13 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm system.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project. Provide testing report, insert report into the maintenance manual.
- .4 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.14 SYSTEM STARTUP

- .1 Instruct DCC Representative in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.15 RE-INSTATEMENT OF SERVICES

- .1 All base building electrical services (including fire alarm, security, power, communications) within the building shall be maintained at all time during construction. Any interruption to building services to be coordinated with building management and shall be completed after office hours. Any electrical service interruption will be capable of being re-instated to full capacity within one (1) hour if requested.

3.16 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 in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .4 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .5 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CAN/CSA C22.2 No.65-18, Wire connectors (Trinational standard with NMX-J-543-ANCE and UL 486A-486B).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for round copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.

2.2 HAZARDOUS LOCATIONS

- .1 Electrical equipment installed in Zone 1 or Zone 2 locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and cables and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
 - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 INSTALLATIONS IN HAZARDOUS LOCATIONS

- .1 Electrical wire and box connectors, and installations, in hazardous locations, to be installed in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- .2 Refer to 26 05 00 Common Work Results for Electrical for sealing of conduits.

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.
- .3 Waste Management: separate waste materials for reuse and recycling.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 0.3-09 (R2019), Test Methods for Electrical Wires and Cables.
- .2 ANSI/UL 2196, Test For Fire Resistive Cable - Electrical Circuit Protective System (FHIT) # 25.
- .3 CSA C22.2 No. 38-18, Thermoset-Insulated Wires and Cables (Tri-national Standard, with UL 44 and ANCE NMX-J-451).
- .4 CSA Certified Type FAS to CSA STO C22.2 n° 208-03 (R2013), Fire Alarm and Signal Cable.
- .5 CSA C22.1.2-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations, Includes Errata 1 (2021).
- .6 CSA/ULC S524-19, Standard for Installation of Fire Alarm Systems.

1.2 RELATED REQUIREMENTS

- .1 26 05 00 - Common Work Results for Electrical
- .2 26 05 20 - Wire and Box Connectors - (0-1000 V)
- .3 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings
- .4 33 71 73.02 - Underground Electrical Service

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 – Shop Drawings Product Data and Samples.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RWU90 XLPE and RW90 XLPE.

2.2 TECK 90 CABLES

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Grounding Conductors: Copper
- .3 Circuit Conductors: Copper, size as indicated.
- .4 Insulation: Cross-linked polyethylene XLPE, rated 600V.
- .5 Inner jacket: Polyvinyl chloride material.

- .6 Armour: Aluminum
- .7 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .8 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 3-meter intervals.
 - .3 Threaded rods: 6mm diameter to support suspended channels.

2.3 FIRE ALARM SYSTEMS WIRES

- .1 Copper conductors with coded PVC insulation and with overall red PVC jacket. Cables shall be CSA approved, FAS 300V, 105°C.
- .2 Conductors shall conform to sized indicated by manufacturer, but in any case, the minimum size of any conductor from transponder cabinet to devices shall be:
 - .1 For alarm receiving circuits, min. #16 gauge FAS 105. In no case shall the wire resistance in these circuits exceed 50 ohms.
 - .2 For addressable initiate circuits, min. #18 gauge FAS 105 twisted unshielded conductors run in separate conduit systems.
 - .3 For signal/paging circuits min. #16 gauge FAS 105 twisted unshielded in separate conduit system. Connect horn/strobes in each area wired for A and B signal circuits.
 - .4 24 volts power wiring shall be min. #14 gauge FAS 105.
 - .5 Ground: separate insulated ground wire min. #14 gauge.
- .3 Multiplex risers – min. #14 gauge FAS, twisted pair, shielded, RHH single conductor. Cables ULC rated 2 hours.

2.4 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Type: ACWU90 jacket over armour and compliant to applicable Building Code classification for this project.
- .5 Connectors: anti short connectors.

2.5 WIRING AND CABLES IN HAZARDOUS LOCATIONS

- .1 Electrical equipment installed in Zone 1 or Zone 2 locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

2.6 VFD RATED CABLES

- .1 Cable to be VFD drive rated;
- .2 CSA approved to C22.2 no 123;
- .3 Flame, oil and UV resistant cable;
- .4 Copper conductors;

- .5 Corrugated continuous aluminum sheath;
- .6 3 symmetrically placed bonding conductors;
- .7 Impact and crush resistant;
- .8 Temperature rating 90°C to -40°C;
- .9 1000V 90C rated cross link polyethylene insulation;
- .10 FT4 PVC jacket, suitable for use in hazardous locations;

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of DCC Representative and local Authority Having Jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only.
- .7 Common/shared neutral wires are not permitted for any circuits.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.
- .9 For connections to variable speed drives, VFD drive cable as recommended by drive manufacturers.
- .10 Unless indicated otherwise, wire length between VFD and motor to be less than 15 m with VFD rated cable and properly sized conductors for voltage drop and to mitigate additional harmonics. Confirm requirements with VFD manufacturer.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring in conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by hangers and straps.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels. Maximum length of cable between device and conduit raceway pull box 1.5 meters.
- .2 Armoured cables are only permitted for drops from junction boxes to light fixtures or for connections to vibrating equipment.

3.6 INSTALLATION OF FIRE ALARM SYSTEM CONDUCTOR

- .1 All wiring shall be installed in E.M.T. with steel coupling.
- .2 Install wiring in conformance with the requirements of the Canadian Electrical Code, Part I, and applicable Provincial Codes.
- .3 All wiring shall be identified by coded markers at outlets and pull boxes. **Joints shall only be made at device terminals.**
- .4 The wiring of the life safety systems shall be terminated on coded terminal blocks at all junction points. Prepare composite record drawings, in riser form, showing every junction terminal block and identifying all colour and number codes. Submit these drawings with as-built records.
- .5 Install insulated ground wire in each conduit to be terminated in each junction or pull box. No pass through is acceptable.
- .6 Fire alarm wiring is to be run in continuous lengths from the source enclosure to the field devices, to be free of joints and splices and that all termination's and connection are to take place only at the source enclosure and field devices.

3.7 INSTALLATIONS IN HAZARDOUS LOCATIONS

- .1 Electrical wires and cables, and installations, in hazardous locations, to be installed as noted and in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- .2 Refer to 26 05 00 Common Work Results for Electrical for related requirements.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards (ANSI) Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA Z32-09, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.2 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Shop Drawings Product Data and Samples.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Operation and Maintenance Manual and 01 78 00 – Project Record Documents.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment 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 Materials with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

- .2 Grounding conductors: bare stranded copper, tinned, soft annealed size as required.
- .3 Insulated grounding conductors: green, copper conductors, size as required.
- .4 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.
- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

2.2 IN HAZARDOUS LOCATIONS

- .1 Electrical grounding and bonding installed in Hazardous locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including: conductors, connectors, accessories. Run ground/bond wire in all conduits.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 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.
- .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .8 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.
- .9 Ground secondary service pedestals.
- .10 Electrical equipment installed in Hazardous locations shall be in accordance with CSA C22.1-21

Section 18 and Table 18.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.4 BONDING IN HAZARDOUS LOCATIONS

- .1 Electrical grounding and bonding installed in Hazardous locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- .2 Refer to 26 05 00 Common Work Results for Electrical for related requirements.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of DCC Representative and local Authority Having Jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.6 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 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 ACTIONS 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 hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins.
- .4 Divert unused metal materials from landfill to metal recycling facility.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.

- .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure surface mounted equipment independently of suspended ceilings.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels at 5m on centre spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

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 reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations, Includes Errata (2021).

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings Product Data and Samples.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: connection blocks, main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400A.

2.2 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on flat covers.

2.3 IN HAZARDOUS LOCATIONS

- .1 Splitters, junction and pull boxes, the enclosures shall be approved and comply with the requirements of CSA C22.1-21 Section 18 and Table 18 to meet the Zone classifications indicated.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.
- .3 Splitters installed in Hazardous locations shall be in accordance with CSA C22.1-21 Section 18 and Table 18 to meet the Zone classifications indicated.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 meters above finished floor except where indicated otherwise.
- .3 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.
- .4 Junction, pull boxes and cabinets installed in Hazardous locations shall be in accordance with CSA C22.1-21 Section 18 and Table 18 to meet the Zone classifications indicated.

3.3 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations, Includes Errata (2021).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings Product Data and Samples.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Material and Equipment.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Utility boxes for outlets connected to surface mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.

- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.5 HAZARDOUS LOCATIONS

- .1 Electrical outlet boxes, conduit boxes and fittings installed in Zone 1 or Zone 2 locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

3.2 IN HAZARDOUS LOCATIONS

- .1 Electrical outlet boxes, conduit boxes and fittings installed and installations, in hazardous locations, to be installed in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- .2 Refer to 26 05 00 Common Work Results for Electrical for sealing of conduits.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45.2-08(2013), Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel (Tri-National Standard, with NMX-J-576-ANCE and UL 6A).
 - .3 CSA C22.2 No. 45.1-07(2017), Electrical Rigid Metal Conduit – Steel, includes Update No.1 (2010), Update No.2 (2014), and Update No.3 (2019).
 - .4 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .5 CSA C22.2 No. 83-M1985 (R2013), Electrical Metallic Tubing.
 - .6 CSA C22.2 No. 18.3-12 (R2022), Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B), Includes Update No. 1 (2014) and Update No. 2 (2020)
 - .7 CSA C22.2 No. 211.2-06 (R2021), Rigid PVC (Unplasticized) Conduit, Update No. 1 (2011).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawing Product Data and Samples.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45.2, aluminum threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45.2, with zinc coating and corrosion resistant epoxy finish inside and outside.

- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Connectors and couplings:
 - .1 Interior – To match existing, connectors to be water tight compression style.
 - .2 Hazardous areas classified zone 1 or zone 2 – Explosion proof in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18. Refer to drawings for hazardous group at each area.
 - .3 Exterior – Watertight.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 or 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

2.6 IN HAZARDOUS LOCATIONS

- .1 Electrical conduit, fittings and fasteners installed in Zone 1 or Zone 2 locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use rigid metal conduit with threaded ends in hazardous areas classified zone 1 and zone 2. Threads for conduit and fittings shall be tapered.
- .4 Use rigid aluminum threaded conduit except where specified otherwise. Threads for conduit and fittings shall be tapered.
- .5 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury. EMT can be used in non-hazardous areas not subject to mechanical damage.
- .6 Use flexible metal conduit for connection to motors in dry areas, connection to surface or recessed fluorescent fixtures.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Use explosion proof flexible connection for connection to explosion proof motors.
- .9 Install conduit sealing fitting in hazardous areas.
 - .1 Fill with compound.
- .10 Minimum conduit size for all conduit: 21 mm.
- .11 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .12 Mechanically bend steel conduit over 21 mm diameter.
- .13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .14 Install fish cord in empty conduits.
- .15 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .7 Conduit shall be run vertically in/on walls to devices.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.

- .3 Do not install conduits in terrazzo or concrete toppings.
- .4 Conduit shall be run vertically in/on walls to devices.

3.5 IN HAZARDOUS LOCATIONS

- .1 Electrical conduit, fittings and fasteners and installations, in hazardous locations, to be installed in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- .2 Refer to 26 05 00 Common Work Results for Electrical for sealing of conduits.

3.6 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.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.2 No.29-15, Panelboards and Enclosed Panelboards.

1.2 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common work Results for Electrical.
- .2 Section 26 28 16.02 – Moulded Case Circuit Breakers

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 panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit product data in accordance with Sections 01 33 00 – Submittal Procedures and Section 26 05 00 – Common Work Results - Electrical and as listed below.
 - .2 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

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 panelboards for incorporation into manual.
- .3 Provide typed and updated panel schedules complete with breaker ratings, pole configurations, and load identification.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with – Material and Equipment and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors off ground in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect panelboards from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 and 600 V panelboards: bus and breakers rated for symmetrical interrupting capacity or as indicated.
- .3 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.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10 % of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to DCC Representative.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Provide C-channel frame and install surface mounted panelboards on C-channel frame. Where practical, group panelboards on common frame.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

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 reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55-M1986(R2012), Special Use Switches.
 - .4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 RELATED REQUIREMENTS

- .1 26 05 00 – Common Work Results For Electrical.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Shop Drawings Product Data and Samples.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Operation and Maintenance Manual and 01 78 00 – Project Record Documents.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 SWITCHES

- .1 Extra heavy-duty specification grade 15 A, 347 V, single pole, switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

- .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated fully rated for fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.
- .5 Ceiling mount occupancy sensor with following features:
 - .1 Low Voltage with power pack to control 347V lighting per instance and associated lighting voltage requirements.
 - .2 Low Voltage with power pack to control 120V lighting per instance and associated lighting voltage requirements.
 - .3 Dual Technology (PIR/Micro-phonics)
 - .4 Coverage type: small motion 360 degrees
 - .5 Dual Relays (2 pole).
 - .6 Push button programmable.
 - .7 Color: white.
 - .8 Sensors of one manufacturer throughout project.
 - .9 Suspend to the same plane as the light fixtures, 2750 mm.

2.2 RECEPTACLES

- .1 Extra heavy-duty specification grade duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
 - .1 Tamperproof
 - .2 Ivory urea moulded housing.
 - .3 Suitable for No. 10 AWG for back and side wiring.
 - .4 Break-off links for use as split receptacles.
 - .5 Eight back wired entrances, four side wiring screws.
 - .6 Triple wipe contacts and rivetted grounding contacts.
- .2 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, vertically brushed, 1 mm thick cover plates cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated. All weatherproof covers shall be of the in-use type.

2.4 SOURCE QUALITY CONTROL

- .1 Cover plates from one manufacturer throughout project.

2.5 IN HAZARDOUS LOCATIONS

- .1 Electrical receptacles, attachment plugs and switches installed in Hazardous locations shall be of the type providing for connections to the bonding conductor of the flexible cord, and shall comply with the requirements of CSA C22.1-21 Section 18 and Table 18.
- .2 Electrical switches installed in Hazardous locations shall be provided with enclosures, and the enclosure in each case together with the apparatus shall be approved as a complete assembly and shall comply with the requirements of CSA C22.1-21 Section 18 and Table 18.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 Install GFI type receptacles as indicated.
- .3 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 In Hazardous Locations:
 - .1 Electrical equipment installed in Hazardous locations shall be in accordance with CSA C22.1-21 Section 18 and Table 18 to meet the Zone classifications indicated.

3.2 CLEANING

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

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common work Results for Electrical.

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 circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with ampacity of 100A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .4 Certificates:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
 - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by DCC Representative. Unless complying with this requirement, DCC Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
 - .4 Production certificate of origin must contain:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
 - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
 - .3 Contractor's name and address and person responsible for project.
 - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
 - .5 Name and address of building where circuit breakers will be installed:
 - .1 Project title
 - .2 End user's reference number (coordinate with DCC representative)
 - .3 List of circuit breakers

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Material and

- Equipment and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store circuit breakers in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
 - .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.

PART 2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as shown on drawings.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Install circuit breakers as indicated.

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 reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CAN/CSA C22.2 No.144-06(R2015), Ground Fault Circuit Interrupters.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters 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 Ontario, Canada.
- .4 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to DCC Representative and certificate that system as installed meets criteria specified.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, packaging materials as specified in Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA C22.2 No.144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained with 15 or 20 A, 120 V circuit interrupter and duplex receptacle complete with:
 - .1 Solid state ground sensing device.
 - .2 Facility for testing and reset.
 - .3 CSA Enclosure 1, surface mounted with stainless steel face plate.
 - .4 Heavy duty specification grade
 - .5 Receptacle to be flush mounted in washrooms with stainless steel faceplate.
 - .6 Receptacles to be surface mounted for roof receptacles with in-use weatherproof covers.
 - .7 Receptacles installed outside of the building are to be weather rated, supplied with in-use weatherproof covers.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Do not ground neutral on load side of ground fault relay.
- .2 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical and co-ordinate with Section 01 45 00- Quality Control.
- .2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.
- .3 Demonstrate simulated ground fault tests.

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 recycling in accordance with Section 01 74 11- Cleaning.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CAN/CSA-C22.2 No.4-04(R2009), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
 - .2 CAN/CSA-C22.2 No.39-13, Fuseholder Assemblies.

1.2 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.3 ACTIONS 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 disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Material and Equipment 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 in clean, dry, well-ventilated area.
 - .2 Store and protect disconnect switches - fused and non-fused 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, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan.

PART 2 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Non-fusible, Horsepower rated disconnect switch in CSA enclosure to CAN/CSA-C22.2 No.4 size as indicated.

- .2 Provision for padlocking in on-off and off switch position by 3 locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 IN HAZARDOUS LOCATIONS

- .1 Switches, motor controllers, circuit breakers and fuses, including pushbuttons, relays, and similar devices, shall be provided with enclosures, and the enclosure in each case together with the apparatus shall be approved as a complete assembly and shall comply with the requirements of CSA C22.1-21 Section 18 and Table 18 to meet the Zone classifications indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

3.2 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.
- .2 Electrical equipment installed in Hazardous locations shall be in accordance with CSA C22.1-21 Section 18 and Table 18 to meet the Zone classifications indicated.

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.

END OF SECTION

Part 1. General

1.1 REFERENCE STANDARDS

- .1 IEC 947-4-1, Part 4: Contactors and Motor-Starters.

1.2 RELATED REQUIREMENTS

- .1 26 05 00 – Common Work Results for Electrical

1.3 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Sections 01 33 00 – Submittal Procedures and Section 26 05 00 – Common Work Results - Electrical and as listed below.
- .2 Product Data:
 - .1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 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 Ontario, Canada.
 - .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit operation and maintenance data for each type and style of motorstarter for incorporation into maintenance manual.
- .3 Extra Materials:
 - .1 Provide listed spare parts for each different size and type of starter
 - .1 3 contacts, stationary.
 - .2 3 contacts, movable.

- .3 1 contacts, auxiliary.
- .4 1 control transformers.
- .5 1 operating coil.
- .6 2 fuses.
- .7 10% indicating lamp bulbs used.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove or reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 RELATED WORK

- .1 Refer to mechanical shop drawings or product data to ensure starter type, size and function are suited to the application. If changes to service or controls are required, notify DCC Representative.
- .2 Refer to schematic diagrams on drawings for control functions of starters.
- .3 Refer to Motor Control Schedule.
- .4 Refer to Divisions 21, 22 and 23 Specifications and Shop Drawings.

1.7 RECORD DRAWINGS

- .1 Show interconnection of Division 21, 22 & 23 and Division 26 components on record drawings.

1.8 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for motor starters incorporated into manual specified in Sections 01 33 00 – Submittal Procedures and Section 26 05 00 – Common Work Results - Electrical.
- .2 Include operation and maintenance data for each type and style of starter.

Part 2. Products

2.1 MATERIALS

- .1 All starters and components to be new, CSA approved for the application and to IEC 947-4 with AC4 utilization category.

- .2 Half size starters not acceptable.

2.2 MANUAL MOTOR STARTERS

- .1 Single or three phase, HOA, toggle or key type, rating and enclosure type as indicated.
- .2 Overload heaters, one (1) per phase, sized to motor nameplate current and red LED type "RUN" pilot light. Manual reset and trip indicating handle.
- .3 Quick make, quick break operating mechanism.
- .4 Locking tab to permit padlocking in "ON" or "OFF" position
- .5 Flush type except in mechanical and electrical service rooms and parking garages which may be surface type.

2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated rapid action type.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Power and control terminals.
 - .4 Wiring and schematic diagram inside starter enclosure in visible location.
 - .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination magnetic type starters to include, in addition to the above, motor circuit protector with operating lever on outside of enclosure, and provision for:
 - .1 Locking in "OFF" position with up to three (3) padlocks.
 - .2 Locking in "ON" position.
 - .3 Independent locking of enclosure door.
 - .4 Provision for preventing switching to "ON" position while enclosure door is open.
- .3 Accessories:
 - .1 Overload reset button, HOA switch in cover, field convertible to OFF/AUTO or START/STOP push button as indicated.
 - .2 Indicating lights: LED type with push to test feature.
 - .3 Relay for thermistor wiring where the thermistors are provided in the motors.
 - .4 Control transformer primary and secondary fusing – primary fusing to be HRC type – for each starter in its own enclosure. Control voltage 120V or as indicated.
 - .5 1-N/O and 1-N/C spare auxiliary contacts in addition to the auxiliary contacts required for the necessary controls.
 - .6 Press-to-Test facility.

2.4 MOTOR CIRCUIT PROTECTORS

- .1 As moulded circuit breaker except that there is no thermal protection. MCPs to operate on the magnetic principle with a current sensing coil in each of the three poles to provide short circuit protection. The magnetic trip setting shall be adjustable from the front of the MCPs.
- .2 Interrupting rating shall be equal to or greater than the short circuit fault level at the point of application. Where required, the MCPs shall be complete with current limiter attachments to provide an increased interrupting capacity of 200,000 A, rms, symmetrical.
- .3 Ensure that the selected sizes of the MCPs correspond to the motor sizes and are to the approval of the motor manufacturer.
- .4 MCPs shall be CSA listed and in addition tested by the control manufacturer in combination with pertinent starter.

2.5 CONFIRMATION OF SIZE FOR MECHANICAL EQUIPMENT

- .1 Review mechanical shop drawings to confirm the ratings of equipment and related electrical requirements. Ensure that the correct electrical equipment is selected to match the requirements of the mechanical equipment.

Part 3. Execution

3.1 INSTALLATION

- .1 Install starters other than those in Motor Control Centres, connect power and control wiring as indicated and as required for complete and functional mechanical systems. In finished areas, provide flush mounted starters in suitable box, complete with stainless steel coverplates.
- .2 Ensure correct motor circuit protectors and overload devices elements installed. When selecting overload device trip settings take into account all factors including, motor type, service factor, full load current and the effect of power factor correction capacitors when installed across the motor.
- .3 Confirm the electrical characteristics and wiring requirements of mechanical equipment prior to ordering.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and manufacturer's instructions.
- .2 Operate switches and contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 ASTM International Inc.
 - .1 ASTM F1137/F1137M-19, Standard Specification for Phosphate/Oil Corrosion Protective Coatings for Fasteners.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA C866-17 (R2022), Performance of LED luminaires.
- .4 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings Product Data and Samples.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by DCC Representative.
 - .3 Photometric data to include: spacing criterion.
- .3 Quality Assurance Submittals: Provide 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.

1.3 QUALITY ASSURANCE

- .1 Provide mock-ups in accordance with Section 01 45 00 - Quality Control.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Divert unused metal materials from landfill to metal recycling facility.
- .3 Disposal and recycling of fluorescent lamps as per local regulations.
- .4 Disposal of old PCB filled ballasts as per regulations.

Part 2 Products

2.1 LED Lighting/Fixtures

- .1 Performance Testing:
 - .1 Fixture to be tested in accordance with IESNA LM-80-08 and LM-79-08 for LED performance for delivered lumens and system efficacy.

- .2 Linear style fixture to deliver (80 LPW) or better for interior application and similar performance in other styles.
- .3 Fixtures to have a life expectancy in the range of 50,000 hours at 70% lumen maintenance rating.
- .4 Optics designed for LED technology through the use of reflectors, lenses or diffuser or any combination for optical efficiency.
- .2 Thermal Management:
 - .1 Fixture to be designed to allow for the dissipation of heat away from the fixture and solid state components using heat sinks and/or reflective materials or design components.
 - .2 Thermally protected. In locations with direct contact with insulation, fixture or housing to be IC rated for application.
- .3 Color Quality:
 - .1 LED color temperature to remain relatively stable over its life. Interior light fixtures to have a minimum CRI of 80, exterior luminaires to be minimum 70 CRI.
 - .2 LED color consistency to be provided by binning (sorting) for proper color mixing.
 - .3 Color temperature for indoor fixtures to be 4000K.
- .4 Electrical:
 - .1 Fixtures to be compatible for control through dimming and energy controls for extended maintenance life and reduced energy use.
 - .2 LED lightbars to be mounted on mounting bars or plates with quick disconnect for ease of replacement.
 - .3 CSA approved.
 - .4 Driver to be 350mA for extended LED life and rated 0-10V for dimming or controls application.

2.2 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.3 LUMINAIRES

- .1 As indicated on drawings.

2.4 LUMINAIRES IN HAZARDOUS LOCATIONS

- .1 Luminaires in Zone 1 locations:
 - 1. Electrical equipment installed in Zone 1 locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- .2 Luminaires in Zone 2 locations:
 - 1. Electrical equipment installed in Zone 2 locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated on drawings and as per CSA C22.1 Section 30.
- .2 Provide adequate support to suit ceiling system.
- .3 Secure light fixtures to building structure independent of suspended ceilings.

- .4 Install luminaires in hazardous locations in accordance with CSA C22.1-21 Section 18 and Section 30.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Install flexible or rigid conduit for luminaires as indicated.
- .2 Wiring methods for luminaires in hazardous locations to be in accordance with CSA C22.1-21 Section 18 and Section 30.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations for suspended ceiling installations support luminaires independently of ceiling using jack chains and 's' hooks connected directly to the building structure.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.2 No. 141-15 (R2019), Emergency Lighting Equipment.

1.2 RELATED REQUIREMENTS

- .1 Section 26 05 21 - Wires and Cables (0-1000 V)
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings
- .3 Section 26 50 00 - Lighting

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 emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

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 emergency lighting 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, packaging materials, crates, padding in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

1.6 WARRANTY

- .1 For batteries in this Section 26 52 00- Emergency Lighting, 12 months warranty period is extended to 60 months.

Part 2 Products

2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120/347V (as indicated in drawings), AC.
- .3 Output voltage: 12V DC.
- .4 Operating time: 30 minutes.
- .5 Battery: sealed, maintenance free.
- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .7 Solid state transfer circuit.
- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 12VDC or to match existing battery units, 6W.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12 Finish: baked enamel white.
- .13 Auxiliary equipment:
 - .1 Ammeter.
 - .2 Voltmeter.
 - .3 Test switch.
 - .4 Time delay relay.
- .14 Standard of Acceptance Manufacturers:
 - .1 Lumacell
 - .2 Beghelli
 - .3 Aimlite
 - .4 Stanpro

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT to 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings
- .2 Conductors: RW90, sized in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.

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 in accordance with Waste management plan.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 141-15 (R2019), Emergency Lighting Equipment.
 - .2 CAN/CSA C860-11 (R2020), Performance of Internally Lighted Exit Signs, Includes Update No. 1 (2011)
- .2 International Organization for Standardization (ISO)
 - .1 ISO 3864-1 2011, Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings.
 - .2 ISO 7010 2011, Safety colours and safety signs - Registered safety signs.

1.2 RELATED REQUIREMENTS

- .1 Section 02 81 00 - Hazardous Materials

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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit WHMIS SDS - Safety Data Sheets.
- .4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00- Quality Control.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and replacement parts.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling and/or reuse in accordance with Section 01 74 11- Cleaning.

Part 2 Products

2.1 STANDARD UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: extruded aluminum housing, brush aluminum finish.
- .3 Faceplates: Lexan.
- .4 Lamps: multiple LED-5W over 500,000 hours.

- .5 Operation: designed for over 500,000 hours of continuous operation without relamping.
- .6 Downlight: translucent acrylic in bottom of unit.
- .7 Graphics: Green pictogram and white graphical symbol and directional arrows to ISO 3864-1. Dimensions to ISO 7010.
- .8 Face plate to remain captive for relamping.
- .9 Voltage: 120V.

2.2 DESIGN (X1)

- .1 Surface ceiling mounting or wall mounted as indicated in the drawings.
- .2 Double and single face as indicated.
- .3 Standard of Acceptance Manufacturers:
 - .1 Lumacell
 - .2 Beghelli
 - .3 Aimlite
 - .4 Stanpro

2.3 IN HAZARDOUS LOCATIONS

- .1 Electrical equipment installed in Hazardous locations shall be in accordance with CSA C22.1-21 Section 18, Section 20 and Table 18.
- .2 Standard of Acceptance Manufacturers:
 - .1 Rig-A-Lite
 - .2 Lightalarms
 - .3 Aimlite
 - .4 Stanpro
 - .5 Lumacell
 - .6 Beghelli

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.

- .4 Ensure that exit light circuit breaker is locked in on position.
- .5 Install exit signs in hazardous locations to be in accordance with CSA C22.1-21 Section 18 and Table 18.
- .6 Wiring methods for exit signs in hazardous locations to be in accordance with CSA C22.1-21 Section 18.
- .5

3.3 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.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Government of Canada:
 - .1 CSA C22.2 No. 141-15 (R2019), Emergency Lighting Equipment.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 CSA C22.2 No. 141-15 (R2019), Emergency Lighting Equipment.
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524:2019, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S526:2016, Visible Signal Devices for Fire Alarm and Signaling Systems, Including Accessories.
 - .3 CAN/ULC-S527:2019, Standard for Control Units for Fire Alarm Systems.
 - .4 CAN/ULC-S536:2019, Standard for Inspection and Testing of Fire Alarm Systems.
 - .5 CAN/ULC-S537:2019, Standard for Verification of Fire Alarm Systems.
 - .6 CAN/ULC-S528-14, Manual Pull Stations for Fire Alarm Systems, Including Accessories.
 - .7 CAN/ULC-S529:2016, Standard for Smoke Detectors for Fire Alarm Systems.
 - .8 CAN/ULC-S530-M91(REV1), Standard for Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .9 ULC-S588:2017 Standard for Gas and Vapour Detectors and Sensors, including Accessories
 - .10 CAN/ULC-S1001_2023, Integrated Systems Testing of Fire Protection and Life Safety Systems

1.2 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Result for Electrical.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 – General Instructions.
- .2 Shop Drawings:
 - .1 Submit shop drawings to the DCC Representative for approval prior to start of construction. Shop drawings to be provided for all new equipment and devices.
 - .1 Shop drawings: stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .2 Include:
 - .1 Layout of equipment with zone/address identification.
 - .2 Existing zoning within area of work.

- .3 Complete wiring diagram of new devices, including schematics of modules.

- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 – General Instructions.

- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installations instructions.
- .3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 33 00.
- .2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.
- .3 Submit to Authority of Jurisdiction 2 sets of approved submittals and drawings immediately after approval but no later than 15 working days to prior to final inspection.
- .4 Submit following:
 - .1 System wiring diagrams:
 - .1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.
 - .2 Show modules, relays, switches and lamps in control panel.
 - .2 Test Reports:
 - .1 Fire Alarm Verification Report.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in the fire alarm system installations approved by manufacturer.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DESCRIPTION

- .1 Fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital, and multiplexing techniques for data transmission.
- .2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.
- .3 Zoned, non-coded single stage.
- .4 Modular in design to allow for future expansion.
- .5 Operation of system shall not require personnel with special computer skills.
- .6 System to include:
 - .1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.
 - .2 Power supplies.
 - .3 Initiating/input circuits.
 - .4 Output circuits.
 - .5 Auxiliary circuits.
 - .6 Wiring.
 - .7 Manual and automatic initiating devices.
 - .8 Audible/Visual signalling devices.
 - .9 End-of-line resistors.
 - .10 Local annunciators.
 - .11 Event log memory chip.
 - .12 Historic event recorder.
- .7 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .8 Power supply: to CAN/ULC-S524.
- .9 Audible signal devices: to CAN/ULC-S524.
- .10 Control unit: to CAN/ULC-S527.
- .11 Manual pull stations: to CAN/ULC-S528.

- .12 Thermal detectors: to CAN/ULC-S530.
- .13 Smoke detectors: to CAN/ULC-S529.
- .14 Regulatory Requirements:
 - .1 System components: listed by ULC and comply with applicable provisions of NBC, and meet requirements of local authority having jurisdiction.
- .15 Acceptable manufacturers: Chubb Edwards, Simplex Grinnell, Notifier.
- .16 Carbon Monoxide (CO) detectors shall be connected to the fire alarm system. Fire alarm connected CO detectors shall cause the same type of alarm as would a fire detector.

2.2 SYSTEM OPERATION: SINGLE STAGE – SIGNALS ONLY

- .1 Actuation of any alarm initiating device to:
 - .1 Cause electronic latch to lock-in alarm state at central control unit.
 - .2 Indicate zone of alarm at central control unit display.
 - .3 Cause audible signalling devices to sound continuously throughout building and at central control unit and visual signalling devices to strobe.
 - .4 Transmit signal to fire hall via central station.
 - .5 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement.
 - .6 Cause fire doors and smoke control doors, if normally held open, to close automatically.
- .2 Acknowledging alarm: indicated at central control unit.
- .3 Ensure that it is possible to silence signals by "alarm silence" switch at control unit, after 60 seconds period of operation.
- .4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.
- .5 Actuation of supervisory devices to:
 - .1 Cause electronic latch to lock-in supervisory state at central control unit.
 - .2 Indicate respective supervisory zone at central control unit.
 - .3 Cause audible signal at central control unit to sound.
 - .4 Activate common supervisory sequence.
- .6 Resetting supervisory or alarm device not to return system indications/functions back to normal until control unit has been reset.
- .7 Trouble on system to:
 - .1 Indicate circuit in trouble at central control unit.
 - .2 Activate "system trouble" indication, buzzer and common trouble sequence.
Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.
- .8 Trouble on system: suppressed during course of alarm.

- .9 Trouble condition on any circuit in system not to initiate alarm conditions.

2.3 CONTROL PANEL

- .1 Suitable for DCLA communication style: to CAN/ULC-S524.
- .2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.
- .3 Minimum capacity of addressable 250 monitoring and 500 addressable control/signal points. Points may be divided between 2 communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other channel. No circuit is to be loaded to more than 80% of its maximum capacity and fire alarm panel is to have a minimum of 20% spare initiating and annunciating circuit zoning capacity and a minimum of 20% spare zone notification LEDs.
- .4 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.
- .5 Integral power supply, battery charger and standby batteries.
- .6 Basic life safety software: retained in non volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (i.e. zone labels, priorities) and changing of system operation software.
- .7 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.
- .8 Support up to 6 RS-232-C I/O ports. CCU output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC. Provide ethernet ports
- .9 Equipped with software routines to provide Event-Initiated-Programs (EIP); change is status of one or more monitor points, may be programmed to operate any or all of system's control points.
- .10 Software and hardware to maintain time of day, day of week, day of month, month and year.
- .11 Connection to CFB Borden Fire Alarm Monitoring system is by existing wireless subscriber. Provide for 4 sets of dry contacts for communications with wireless subscribers, at least one which, is for connection to local Fire Hall and can be bypassed. Contractor will be responsible for Subscriber communications cables and conduit to FACP, and connection of relays. RPO electrical shop will assist in testing to the firehall.
- .12 All fire alarm panels shall have the following bypass circuits: Connection to local Fire Hall, Sprinkler system, Door closers, HVAC shutdown and Audible Alarms.
- .13 Panel shall have a dedicated surge suppression/protection device integrated inside the panel. System to be provided with dedicated transient voltage surge protection device (SPD) to protect system electronics from surges and spikes on power lines. SPD units to be as recommended by fire alarm system manufacturer.

2.4 POWER SUPPLIES

- .1 120 V, 60 Hz as primary source of power for system.
- .2 Voltage regulated, current limited distributed system power.
- .3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.
- .4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.
- .5 During normal operating condition's fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.
- .6 Standby batteries: sealed, maintenance free.
- .7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.5 INITIATING/INPUT CIRCUITS

- .1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLA configuration to central control unit.
- .2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.
- .3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".
- .4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to central control unit.
- .5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

2.6 ALARM OUTPUT CIRCUITS

- .1 Alarm output circuit: connected to signals, wired in class A configuration to central control unit.
 - .1 Signal circuits' operation to follow system programming; capable of sounding horns continuously 2 A, 24 VDC; fuse-protected from overloading/overcurrent.
 - .2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

2.7 AUXILIARY CIRCUITS

- .1 Auxiliary contacts for control functions.
- .2 Actual status indication (positive feedback) from controlled device.
- .3 Alarm on system to cause operation of programmed auxiliary output circuits.
- .4 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

- .5 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system.
 - .1 Timing circuit: controlled by CCU.
- .6 Auxiliary circuits: rated at 2A, 24VDC or 120VAC, fuse-protected.

2.8 WIRING

- .1 Refer to specification section 26 05 21 Wiring and Cables (0-1000V), 2.4 Fire Alarm Systems Wiring and 2.6 Wiring and Cables in Hazardous Locations. Copper conductors with coded PVC insulation and with overall red PVC jacket. Cables shall be CSA approved, FAS 300V, 105°C.
 - .1 Twisted copper conductors: rated 300V, 105°C.
 - .2 To initiating circuits: 18AWG minimum FAS105 cable, and in accordance with manufacturer's requirements.
 - .3 To signal circuits: 16AWG minimum FAS105 cable, and in accordance with manufacturer's requirements.
 - .4 To control circuits: 14AWG minimum FAS105 cable, and in accordance with manufacturer's requirements.

2.9 MANUAL ALARM STATIONS

- .1 Addressable manual pull station.
 - .1 Pull lever, break glass rod, surface wall mounted type, single action, single stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.
 - .2 Of weatherproof design where indicated.
 - .3 Suitable for Class I, Zone 2 hazardous / explosion-proof location where indicated.

2.10 AUTOMATIC ALARM INITIATING DEVICES

- .1 Heat detectors, fixed temperature, non-restorable, rated 88 degrees C.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector base in field.
 - .3 Suitable for Class I, Zone 2 hazardous / explosion-proof location where indicated.
- .2 Addressable smoke detector.
 - .1 Photo-electric type.
 - .2 Electronics to communicate detector's status to addressable module/transponder.
 - .3 Detector address to be set on detector head in field.
 - .4 Relay base, where noted, to have form C contacts rated 10A 120V.
- .3 Carbon Monoxide (CO) Detectors.
 - .1 Addressable, meeting ULC-S588 standard for system-connected life safety carbon monoxide detection.
 - .2 Operating temperature 32F – 122F (0C – 50C)
 - .3 ULC Listed: S1115.

2.11 AUDIBLE/VISUAL SIGNAL DEVICES

- .1 Horns: surface mounting, 24 V dc. red, not to exceed 90dBA at 3m.
- .2 Strobe type: flashing, red, 24 V dc, 75cd intensity.
- .3 Designed for surface mounting on walls.
- .4 Of weatherproof design where indicated.
- .5 Suitable for Class I, Zone 2 hazardous / explosion-proof location where indicated.

2.12 PASSIVE GRAPHIC DISPLAY

- .1 Provide revised passive graphic display, to be mounted adjacent to the main fire alarm control panel. Plastic laminate type, black artwork on white background, framed approximate size: 600 x 600 mm. Indicate all fire alarm zones. Submit passive graphic to DCC Representative for approval prior to manufacturing.
- .2 Graphic to show building floor plan with all room numbers, all zones, all duct detectors, sprinkler riser, and sprinkler isolation valves within the multistorey building.

2.13 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in alarm circuits and signaling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.14 ANCILLARY DEVICES

- .1 Remote relay unit to initiate fan shutdown.
- .2 Remote double voltage relay to release door hold open devices.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524.
- .2 Install central control unit and connect to ac power supply.
- .3 Install manual alarm stations and connect to alarm circuit wiring.

- .4 Locate and install detectors and connect to alarm circuit wiring. Mount detectors more than 1 m from air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors.
- .5 Connect alarm circuits to main control panel.
- .6 Install horn/strobes and connect to signalling circuits.
- .7 Connect signalling circuits to main control panel.
- .8 Install end-of-line devices at end of signalling circuits.
- .9 Install door releasing devices.
- .10 Install remote relay units to control fan shut down.
- .11 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .12 Connect fire suppression systems to control panel.
- .13 Splices are not permitted.
- .14 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- .15 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .16 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.
- .17 Addressable loops shall be continuous from device to device and shall not have tee taps incorporated in the system.

3.3 INSTALLATIONS IN HAZARDOUS LOCATIONS

- .1 Installation of Fire Alarm Devices in hazardous locations to be in accordance with CSA C22.1-21 Section 18 and Table 18.
- .2 Wiring methods for Fire Alarm Devices in hazardous locations to be in accordance with CSA C22.1-21 Section 18.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical and CAN/ULC-S537, Division 01 requirements for Quality Control, and in accordance with requirements of latest edition of CAN/ULC-S1001.
- .2 Fire alarm system:
 - .1 Test such device and alarm circuit to ensure manual stations, detectors sprinkler system transmit alarm to control panel and actuate first stage alarm and ancillary devices.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.
 - .4 Addressable circuits system style DCLA:
 - .1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

- .2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
- .3 Provide final PROM program re-burn for system to DCC Representative incorporating program changes made during construction.
- .4 Provide a copy of the final fire alarm program saved on a USB stick to DCC Representative.
- .5 Integrated Testing
 - .1 Engage Integrated Testing Coordinator to prepare Integrated Testing Plan and provide requirements in accordance with CAN/ULC-S1001.
 - .2 Include for but not be limited to full review, testing and verification of operation of integrated systems such as fire suppression systems, life safety systems, HVAC equipment, supervisory annunciation of sprinkler/standpipe monitor switches, pressure switches and flow switches, security alarms, BAS alarms, release of door holders and electromagnetic locks, and other integrated components.
 - .3 Coordinate requirements with trades responsible for integrated components and systems, and arrange trades to be present at time of testing, and verification and commissioning work.

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 recycling in accordance with Section 01 74 11 – Cleaning
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Place materials defined as hazardous or toxic waste in designated containers.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by fire alarm system installation.

3.7 CLOSEOUT ACTIVITIES

- .1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.
- .2 Provide a copy of the final fire alarm program saved on a USB stick to DCC Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D698-12(2021), Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
- .2 CSA Group
 - .1 CSA B651-2023 Accessible Design for the Built Environment.
- .3 Ontario Provincial Standards Specifications (OPSS)
 - .1 OPSS 351 – Construction Specification for Concrete Sidewalk.
 - .2 OPSS 1351 -
 - .3 OPSS.MUNI 353 – Construction Specification for Concrete Curb and Gutter Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, and limitations.
- .3 Inform DCC Representative of proposed source of materials and provide access for sampling minimum 4 weeks prior to commencing work.
- .4 If materials have been tested by accredited testing laboratory within previous 2 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 47 19 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .2 Reinforcing steel: in accordance with Section 03 20 00- Concrete Reinforcing.
- .3 Joint filler and Curing Compound: in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .4 Granular base: material to OPSS 251 following requirements.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds reacting with free lime to provide water-soluble soap.
- .6 Abutting Joint Filler: Premoulded bituminuous fibre board, conforming to ASTM D1751.
- .7 Rigid Insulation: Extruded polystyrene (XPS), to CAN/ULC-S701, Type 4, minimum 210 kPa compressive strength.

Part 3 Execution

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with OPSS 351.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials.
 - .1 Dispose of surplus and unsuitable excavated material off site.

3.2 GRANULAR BASE

- .1 Obtain DCC Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths suit new concrete walkways.
- .3 Compact granular base in maximum 150 mm layers to minimum 95 % of maximum density to ASTM D698.

3.3 CONCRETE

- .1 Obtain DCC Representative's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Provide 400mm steel dowel with 200mm embedment into existing concrete slab with adhesive anchor, to tie existing concrete sidewalk with new sidewalk.
- .3 Do concrete work in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .4 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations, by drawing broom side to side across sidewalk.

- .5 Provide edging as indicated with 10 mm radius edging tool.
- .6 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to DCC Representative can be demonstrated. Hand finish surfaces when directed by DCC Representative.

3.4 TOLERANCES

- .1 Finish surfaces: in accordance with OPSS 351 and OPSS.MUNI 353.

3.5 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete stiff, but still plastic, at intervals max. of 3m.
- .2 When sidewalk adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.6 ISOLATION JOINTS

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .3 Seal isolation joints with sealant approved by DCC Representative.

3.7 CURING

- .1 Apply curing compound evenly to form continuous film, in accordance with OPSS 351.

3.8 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by DCC Representative.
 - .1 Compact and shape to required contours as directed by DCC Representative.

3.9 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 02 41 13 - Selective Site Demolition

1.2 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
- .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15m³ bucket. Frozen material not classified as rock.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
- .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: Excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: Material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: Material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
- .1 Weak, chemically unstable, and compressible materials.
- .2 Frost susceptible materials:
- .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM C136/C136M: Sieve sizes to CAN/CGSB-8.2.

- .2 Table:

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

0.005 mm	0 - 45
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- .3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 REFERENCE STANDARDS

- .1 ASTM International (ASTM):
 - .1 ASTM C117- 23, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing
 - .2 ASTM C136/C136M- 19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63(2007)e2, Standard Test Methodfor Particle-Size Analysis of Soils.
 - .4 ASTM D698- 12(2021), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)
 - .5 ASTM D1557- 12(2021), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³)
 - .6 ASTM D4318- 17el, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric
- .3 CSA Group (CSA):
 - .1 CSA-A3001- 23, Cementitious Materials for Use in Concrete
 - .2 CSA-A23.1/A23.2- 24, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
- .4 Ontario Provincial Standard Specification (OPSS):
 - .1 OPSS 401 – 2013, Construction Specification for Trenching, Backfilling and Compaction.
 - .2 OPSS.PROV 1004 – 2012, Material Specification for Aggregates – Miscellaneous.
 - .3 OPSS.MUNI 1010 – 2013, Material Specifications for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Quality Control: in accordance with Section 01 45 00:

- .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2 Submit for review by DCC Representative proposed dewatering and heave prevention methods as described in PART 3 of this Section.
 - .3 Submit to DCC Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
 - .4 Submit to DCC Representative written notice when bottom of excavation is reached.
 - .5 Submit to DCC Representative testing, inspection results, and report as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
- .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field, clearance record from utility authority, and location plan of relocated and abandoned services, as required.
- .4 Samples:
- .1 Submit samples in accordance with Section 01 33 00.
 - .2 Inform DCC Representative at least 4 weeks prior to beginning Work, of proposed source of fill and unshrinkable fill materials and provide access for sampling.
 - .3 Submit 70 kg samples of type of fill and unshrinkable fill specified including representative samples of excavated material.
 - .4 Ship samples prepaid to DCC Representative, in tightly closed containers to prevent contamination and exposure to elements.
 - .5 At least 4 weeks prior to beginning Work, inform DCC Representative source of fly ash and submit samples to DCC Representative.
 - .1 Do not change source of Fly Ash without written approval of DCC Representative.

1.5 QUALITY ASSURANCE

- .1 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Keep design and supporting data on site.
- .4 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

- .5 Do not use soil material until written report of soil test results are reviewed and approved by DCC Representative.

- .6 Health and Safety Requirements:

- .1 Do construction occupational health and safety in accordance with Section 01 70 12.

1.6 1.07 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19.
- .2 Divert excess aggregate materials from landfill to local recycling facility for reuse as directed by DCC Representative.

1.7 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify and establish location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Before beginning excavation Work, notify applicable DCC Representative and authorities having jurisdiction establish location and state of use of buried utilities and structures. DCC Representative and authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by careful soil hydrovac methods.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of DCC Representative before removing and re-routing.
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
 - .1 Conduct, with DCC Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by DCC Representative.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to OPSS.MUNI 1010 and the following requirements:

- .1 Crushed, pit run or screened stone, gravel, or sand.
.2 Gradations to be within limits specified when tested to ASTM C136/C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.2.
.3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
3.75 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by DCC Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Unshrinkable fill: proportioned and mixed to provide:
- .1 Maximum compressive strength of 0.4 MPa maximum at 28 days.
.2 Minimum strength of 0.07 MPa at 24 h.
.3 Concrete aggregates: To CSA-A23.1/A23.2
.4 Cement: Type GU.
- .4 Shearmat: Honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.

Part 3 EXECUTION

3.1 SITE PREPARATION

- .1 Remove obstructions, ice, and snow from surfaces to be excavated within limits indicated.
- .2 Cut slab-on-grade, pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with Section 02 41 13 - Selective Site Demolition.

3.2 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with Section 01 56 00 and applicable local regulations.
- .2 Keep excavations clean, free of standing water and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to DCC Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.3 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as directed by DCC Representative after area has been cleared of brush, weeds, grasses, and removed from site.
- .2 Strip topsoil to depths as directed by DCC Representative.
 - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by DCC Representative.
 - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil as directed by DCC Representative.

3.4 STOCKPILING

- .1 Stockpile fill materials in areas designated by DCC Representative.
 - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 70 12 and Health and Safety Act for the Province of Ontario.
 - .1 Where conditions are unstable, DCC Representative to verify and advise methods.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .3 Construct temporary Works to depths, heights and locations as indicated and approved by DCC Representative.
- .4 During backfill operation:
 - .1 Unless otherwise indicated or directed by DCC Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500mm above toe of sheeting.
- .5 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as directed by DCC Representative.

3.6 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for DCC Representative's review and approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved collection and runoff areas and in manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.7 EXCAVATION

- .1 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02 41 19.

- .2 Excavation must not interfere with bearing capacity of adjacent foundations.
- .3 For trench excavation, unless otherwise authorized by DCC Representative in writing, do not excavate more than 30m of trench in advance of installation operations and do not leave open more than 15m at end of day's operation.
- .4 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by DCC Representative.
- .5 Restrict vehicle operations directly adjacent to open trenches.
- .6 Dispose of surplus and unsuitable excavated material in approved location.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify DCC Representative when bottom of excavation is reached.
- .10 Obtain DCC Representative approval of completed excavation.
- .11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by DCC Representative.
- .12 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete having a minimum of 30MPa compressive strength at 28 days.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .13 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of DCC Representative.

3.8 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 and ASTM D1557.
- .2 Within building area: use Type 2 to underside of base course for floor slabs. Compact to 100 % of corrected maximum dry density.
- .3 Place unshrinkable fill in areas as indicated.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated and as specified in Section 23 11 23.
- .2 Place bedding and surround material in unfrozen condition.

3.10 3.10 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of the following:
 - .1 DCC Representative has inspected and approved installations.
 - .2 DCC Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to existing grades. Compact (when not lean concrete) each layer before placing succeeding layer.
- .5 Backfilling around installations:
 - .1 Place bedding and surround material as indicated.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 150 mm per layer of granular or 600mm of vertical height per concrete pour. Allow minimum 24 hrs between each lean concrete fill pour.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 If approved by DCC Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by DCC Representative.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.

3.11 3.11 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 19, trim slopes, and correct defects as directed by DCC Representative.

- .2 Replace topsoil as directed by DCC Representative.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by DCC Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A53/A53M-22, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A90/A90M-21, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - .3 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) coatings on Iron and Steel Products.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-138.1-2019, Fabric for Chain Link Fence.
 - .2 CAN/CGSB-138.2-2019, Steel Framework for Chain Link Fence.
 - .3 CAN/CGSB-138.3-2019, Installation of Chain Link Fence.
 - .4 CAN/CGSB-138.4-2019, Gates for Chain Link Fence.
 - .5 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

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 concrete mixes, fences, posts and gates and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 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 accordance with manufacturer's recommendations.
 - .2 Store and protect fence and gate materials from damage.

- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .2 Chain-link fence fabric: to CAN/CGSB-138.1.
 - .1 Type 1, Class A, heavy style, Grade 1.
 - .2 Height of fabric: 2.44 m.
 - .3 Thickness: 3.66mm.
 - .4 Opening size: maximum 50mm.
- .3 Posts, braces and rails: to CAN/CGSB-138.2, Type 1, galvanized steel pipe. Dimensions as indicated with post spaced no more than 3m.
- .4 Tie wire fasteners: aluminum wire.
- .5 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.
- .6 Gates: to CAN/CGSB-138.4.
- .7 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.
 - .1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.
 - .2 Fasten fence fabric to gate with twisted selvage at top.
 - .3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.
 - .4 Furnish double gates with chain hook to hold gates open.
 - .5 Furnish double gates with heavy-duty, galvanized-steel bearing, rubber wheels.
- .8 Fittings and hardware: to CAN/CGSB-138.2 galvanized steel.
 - .1 Tension bar bands: 5 x 20 mm minimum galvanized steel.
 - .2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.
 - .3 Turnbuckles to be drop forged.
- .9 Organic zinc rich coating: to CAN/CGSB-1.181.

2.2 FINISHES

- .1 Galvanizing:
 - .1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.

- .2 For pipe: 550 g/m² to ASTM A90.
- .3 For other fittings: to ASTM A123/A123M.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative 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 DCC Representative.

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.
 - .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 Grading:
 - .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.
 - .1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.3 ERECTION OF FENCE

- .1 Erect fence along lines as indicated and to CAN/CGSB-138.3.
- .2 Post footings: Construct post footings to dimensions indicated:
 - .1 Line posts: 1524 mm depth x 250 mm diameter.
 - .2 Terminal posts: 1824 mm depth x 250 mm diameter.
- .3 Space line posts 3 m apart, measured parallel to ground surface.

- .4 Space straining posts at equal intervals not to exceed 150m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150m.
- .5 Install additional straining posts at sharp changes in grade and where directed by DCC Representative.
- .6 Install corner post where change in alignment exceeds 10 degrees.
- .7 Install end posts at end of fence and at buildings.
 - .1 Install gate posts on both sides of gate openings.
- .8 Place concrete in post holes then embed posts into concrete to minimum 600 mm depth.
 - .1 Extend concrete 50 mm above ground level and slope to drain away from posts.
 - .2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .9 Install fence fabric after concrete has cured, minimum of 5 days.
- .10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface.
 - .1 Install braces on both sides of corner and straining posts in similar manner.
- .11 Install overhang tops and caps.
- .12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.
- .13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.
- .14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.
 - .1 Knuckled selvedge at bottom.
 - .2 Twisted selvedge at top.
- .15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals.
 - .1 Give tie wires minimum two twists.

3.4 INSTALLATION OF GATES

- .1 Install gates in locations as indicated.
- .2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.
- .3 Determine position of centre gate rest for double gate.
 - .1 Cast gate rest in concrete for Terminal posts.

- .4 Install gate stops where indicated.

3.5 TOUCH UP

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas.
 - .1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.6 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 in accordance with Section 01 74 19- Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Final Report

Department of National Defence

DESIGNATED SUBSTANCES SURVEY

Building A-243

17 Hangar Road, Borden, Ontario

DCC Project: BN300075

Contract: KN75955

March 23, 2022

Arcadis Project: 30094312

DESIGNATED SUBSTANCES SURVEY



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Building A-243
17 Hangar Road
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March 23, 2022

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EXECUTIVE SUMMARY

Arcadis Canada Inc. (Arcadis) was retained by Defence Construction Canada (DCC) on behalf of the Department of National Defence (DND) to conduct a designated substances survey at Building A-243, located at 17 Hanger Road, Borden, Ontario.

The objective of the project was to conduct a designated substances survey to assist DND in meeting their obligations to manage designated substances and hazardous materials as required by DND/CF Asbestos Management Directive (2007) and COHS Regulations Part X, Division II. DND also references Ontario Regulation 278/05 – *Asbestos in Construction Projects and in Buildings and Repair Operations* and the Ontario Regulation 490/09 – Designated Substances.

Building A-243 is a refinishing facility which includes various offices, classrooms and fabrication rooms. It is a two-storey, rectangular structure with a gross floor area of 1393.55 m², flat roof and fixed windows. It was constructed in 1985. There is also a Paints, Oils and Lubricants (POL) Shed, which is part of the main building.

Table ES-1 Summary of Designated Substances and Hazardous Materials

Hazardous Material or Designated Substance	Description of Homogenous Material	Concentration	Location	Estimated Quantity	Condition	Accessibility	Potential Release of Fibers	Action Level	Abatement Requirements	Notes
Potential asbestos-containing materials	Various building materials ⁽¹⁾	N/A	Throughout the building	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silica	Various building materials ⁽²⁾	N/A	Throughout the building	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCBs	T12 light ballasts (to be confirmed by electrician at time of removal)	N/A	Room 203	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ODSs	Wall-mounted air conditioners	N/A	Room 101	One	N/A	N/A	N/A	N/A	N/A	N/A
ODSs	Window-mounted air conditioners	N/A	Rooms 102 and 105	Two	N/A	N/A	N/A	N/A	N/A	N/A
ODSs	Drink fridge	N/A	Room 202	One	N/A	N/A	N/A	N/A	N/A	N/A
ODSs	Mini-fridge	N/A	Room 102	One	N/A	N/A	N/A	N/A	N/A	N/A
ODSs	Ceiling-mounted air conditioner	N/A	Room 205	One	N/A	N/A	N/A	N/A	N/A	N/A
Mould	2'x4' ceiling tiles	N/A	Room 205	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

- (1) Potential asbestos-containing materials observed in the subject included boiler insulation, ceramic floor tile grout and mortar beds, exterior window caulking and roofing materials.
- (2) Materials observed in the subject building which should be considered to contain silica included concrete, concrete blocks, brick, mortar, drywall, drywall joint compound, ceramic floor tile grout and mortar beds.

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ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-Containing Material
Arcadis	Arcadis Canada Inc.
CLC	Canada Labour Code
CAF	Canadian Armed Forces
COHSR	Canada Occupational Health and Safety Regulations
DCC	Defence Construction Canada
DND	Department of National Defence
DSHMS	Designated Substances and Hazardous Materials Survey
HWH	Hot Water Heating
MOL	Ministry of Labour
OEL	Occupational Exposure Limit
OHSA	Occupational Health and Safety Act
OSHA	United States Occupational Health and Safety Administration
PCBs	Polychlorinated Biphenyls
PLM	Polarized Light Microscopy
POL	Paints, Oils and Lubricants
TEM	Transmission Electron Microscopy
UFFI	Urea Formaldehyde Foam Insulation
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by Defence Construction Canada (DCC) on behalf of the Department of National Defence (DND) to conduct a designated substances survey at Building A-243, located at 17 Hangar Road, Borden, Ontario.

The objective of the project was to conduct a designated substances survey to identify any hazards in order to assist DND in meeting their obligations to manage designated substance and hazardous materials as required by DND/CF Asbestos Management Directive (2007) and COHS Regulations Part X, Division II. DND also references Ontario Regulation 278/05 – *Asbestos in Construction Projects and in Buildings and Repair Operations* and the Ontario Regulation 490/09 – *Designated Substances*.

1.1 Scope of Work

The scope of work for the designated substances and hazardous materials survey was based on the DCC Statement of Work (SOW) dated May 20, 2021 and the Arcadis proposal to DCC dated July 19, 2021, and included the following tasks:

1. Submitting a Health and Safety Plan (HASP) prior to commencing field work on the project, and a detailed schedule.
2. Reviewing all reports provided by DCC.
3. Conducting a room-by-room survey of designated substances and hazardous materials (asbestos, UFFI, lead, mercury, chromium, arsenic, silica, PCBs, ozone-depleting substances and biological hazards) in the building. Collecting bulk samples of materials for asbestos analysis and paint chip samples for analysis of arsenic, chromium, lead, mercury and PCBs. Repairing all sample locations.
4. Notifying DCC immediately if any conditions that pose an immediate significant threat to human health or the environment are discovered, such as asbestos debris, suspect mould and animal droppings.
5. Sending samples for laboratory analysis.
6. Preparing and submitting draft and final reports in the format outlined in the SOW. Inputting the survey data into the required fields of the asbestos database and paint chart provided by DCC.

Mr. Dwayne Kellyman and Mr. Viraj Daruwala of Arcadis visited the site on October 12, 2021, to conduct the designated substances survey.

1.2 Building Summary Information

Building A-243 is a refinishing facility which includes various offices, classrooms and fabrication rooms. It is a two-storey, rectangular structure with a gross floor area of 1393.55 m², flat roof and fixed windows. It was constructed in 1985. There is also a Paints, Oils and Lubricants (POL) Shed, which is part of the main building.

Exterior finishes include metal sidings and parging cement. Interior finishes include vinyl floor tiles, vinyl sheet flooring, concrete, and ceramic tile; drywall, wood, and concrete block walls; and drywall, ceiling tiles and metal deck ceilings.

1.3 Summary of Past Designated Substances Survey Reporting

Arcadis reviewed the Maple Environmental Inc. report entitled *Designated Substance and Detailed Asbestos Building Materials Survey Report*, dated March 2011 in preparing this report.

2 BACKGROUND INFORMATION ON DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS

Canada Labour Code

Requirements related to disclosing the presence of hazardous substances (including designated substances) in federal government buildings are specified in Part II of the Canada Labour Code, sections 125(1)y and 125(1)(z.14), which state that employers shall:

- “ensure that the activities of every person granted access to the workplace do not endanger the health and safety of employees [Section y]; and
- take all reasonable care to ensure that all of the persons granted access to the workplace, other than the employer’s employees, are informed of every known or foreseeable health or safety hazard to which they are likely to be exposed in the workplace [Section z.14]”.

Canada Occupational Health and Safety Regulations

The requirement for employers to keep and maintain a record of all hazardous substances that are used, produced, handled or stored for use in the work place and the criteria to employ in carrying out an investigation into potential exposure to a hazardous substance are specified in Part X – Hazardous Substances – of the Canada Occupational Health and Safety Regulations.

Ontario Occupational Health and Safety Act (OHSA)

A decision of the Ontario Superior Court of Justice ⁽¹⁾ confirms that when construction or redevelopment work is undertaken by a company whose primary activity is construction or redevelopment work at the site of a federally-regulated employer, the provincial health and safety laws will apply. The *Ontario Occupational Health and Safety Act* and regulations made thereunder would therefore apply to any construction work undertaken at the subject site.

The *Occupational Health and Safety Act (OHSA)* sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include, but are not limited to:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)];
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)];
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)]; and

⁽¹⁾ Gowlings OHS Law Report – December 2007.

- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

In addition, Section 30 of the OHSA deals with the presence of designated substances on construction projects. Compliance with the OHSA and its regulations requires action to be taken where there is a designated substance hazard on a construction project.

Section 30 of the OHSA requires the owner of a project to determine if designated substances are present on a project and, if so, to inform all potential contractors as part of the bidding process. Contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project.

Regulation for Construction Projects, O.Reg. 213/91

The Regulation for Construction Projects, O.Reg. 213/91, applies to all construction projects. The following sections of the regulation would apply to situations where there is the potential for workers to be exposed to designated substances:

Section 14	(5)	A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project.
Section 21	(1)	A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed.
	(2)	A worker's employer shall require the worker to comply with subsection (1).
	(3)	A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.
Section 30		Workers who handle or use substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.
Section 46	(1)	A project shall be adequately ventilated by natural or mechanical means, if a worker may be injured by inhaling a noxious dust or fume.
	(2)	If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.
Section 59		If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

Regulation for Designated Substances (O.Reg. 490/09)

The Designated Substance Regulation (O.Reg. 490/09) specifies occupational exposure limits (OELs) for eleven designated substances in Ontario (asbestos, lead, mercury, silica, vinyl chloride, acrylonitrile, isocyanates, benzene, arsenic, ethylene oxide and coke oven emissions) and requires an assessment and a control program to ensure compliance with these OELs.

Although O.Reg. 490/09 and the OELs do not apply to an employer on a construction project, or to their workers at the project (O.Reg.490/09, Section 14, Exception – Construction), employers still have a responsibility to protect the health of their workers and to comply with the OHSA and other applicable regulations. Section 25(2)(h) of the OHSA requires that employers take "every precaution reasonable in the circumstances for the protection of a worker".

Other regulatory requirements (and guidelines) which apply to control of exposure to designated substances and hazardous materials are referenced in the sections below.

2.1 Asbestos

Asbestos has been widely used in buildings, both in friable applications (materials which can be crumbled, pulverized or powdered by hand pressure, when dry) such as pipe and tank insulation, sprayed-on fireproofing and acoustic texture material, and in non-friable manufactured products such as floor tile, gaskets, cement board and so on. The use of asbestos in friable applications was curtailed around the mid-1970s. The use of asbestos in certain non-friable materials continued beyond the mid-1970s. The import, sale or use of asbestos products was banned in Canada, effective December 30, 2018.

2.1.1 Provincial Government Requirements

Control of exposure to asbestos is governed in Ontario by Regulation 278/05 – *Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations*. Disposal of asbestos waste (friable and non-friable materials) is governed by Ontario Regulation 278/05 and by Ontario Regulation 347, Waste Management – General. O.Reg. 278/05 classifies asbestos work operations into three types (Type 1, 2 and 3), and specifies procedures to be followed in conducting asbestos abatement work.

O. Reg. 278/05 prescribes certain requirements for asbestos management in buildings. For on-going asbestos management in buildings, building owners are required to:

- prepare (and keep on the premises) a record (i.e., asbestos survey report) of the locations of all friable and non-friable asbestos-containing materials in a building;
- inspect asbestos-containing materials at reasonable intervals to determine their condition and update the asbestos survey record at least once in each 12-month period, and whenever asbestos-containing material is removed or discovered;

- give any person who is an occupier⁽²⁾ of the building written notice of any information in the asbestos survey record that relates to the area occupied by the person;
- give contractors written notice of the information in the asbestos survey record if the work to be carried out by contractor may involve asbestos-containing material or may be carried out in close proximity to and may disturb asbestos-containing material;
- advise staff of the information in the asbestos survey record, if work is to be performed in a facility that contains asbestos-containing material;
- provide training for staff based on the responsibilities and duties to be undertaken in relation to asbestos management;
- clean up any fallen asbestos-containing fireproofing or acoustical or thermal insulation (if the material is being disturbed so that exposure to the material is likely to occur);
- repair, seal, remove or permanently enclose asbestos-containing fireproofing as thermal insulation if it is readily apparent that material will continue to fall because of deterioration; and,
- perform work operations which involve disturbance (i.e., cleanup, removal, repair, etc.) of asbestos-containing materials in accordance with the measures and procedures (Type 1, 2 and 3 operations) specified in O. Reg. 278/05.

2.1.2 Federal Government Requirements – Canada Occupational Health and Safety Regulations- Hazardous

The Canada Labour Code Part II – Canada Occupational Health and Safety Regulations, Division II – Hazardous Substances Other Than Hazardous Products prescribes requirements for Asbestos Exposure Management Programs.

2.1.3 Federal Government Requirements – National Joint Council Directive

The National Joint Council Directive, Part XI – Hazardous Substances – 11.6 Asbestos Management – states:

11.6.1 The employer shall comply with federal, provincial, territorial and municipal regulations, statutes and requirements with respect to asbestos-containing materials (ACM) in any government-owned, managed or leased facilities.

11.6.2 An asbestos management program and code of practice meeting the intent of the appropriate standard shall be followed if material containing asbestos may exist in any building or facility.

⁽²⁾ An “occupier” is defined as:

- (a) a person who is in physical possession of premises, or
- (b) a person who has responsibility for and control over the condition of premises or the activities carried on there, or control over persons allowed to enter the premises.

11.6.3 As a minimum requirement, departments and agencies will comply with Public Works and Government Services Canada Policy DP 057 and Code of Practice on Asbestos Management.

2.1.4 DND Asbestos Management Directive

The Department of National Defence (DND) Asbestos Management Directive, March 2007, was developed in order to establish a standard and consistent approach for the management of asbestos-containing materials. The Directive identifies organizational roles and responsibilities, and establishes a comprehensive approach for the identification, management, removal and disposal of asbestos-containing materials within DND buildings and facilities. CFB Borden considers asbestos-containing materials to be 0.5% or more asbestos, by dry weight, in accordance with O. Reg. 278/05.

2.2 Lead

Lead is a heavy metal that can be found in construction materials such as paints, coatings, mortar, concrete, pipes, solder, packings, sheet metal, caulking, glazed ceramic products and cable splices. Lead has been used historically in exterior and interior paints.

The Surface Coating Materials Regulations (SOR/2016-193) made pursuant to the Canada *Consumer Product Safety Act* states that a surface coating material must not contain more than 90 mg/kg total lead. Health Canada defines a lead-containing surface coating as a paint or similar material that dries to a solid film that contains over 90 mg/kg dry weight of lead.

Information from the United States Occupational Health and Safety Administration (OSHA) suggests that the improper removal of lead paint containing 600 mg/kg lead results in airborne lead concentrations that exceed half of the permissible exposure limit. Lead concentrations as low as 90 mg/kg may present a risk to pregnant women and children⁽³⁾.

The National Plumbing Code allowed lead as an acceptable material for pipes until 1975 and in solder until 1986.

The Ontario Ministry of Labour *Guideline, Lead on Construction Projects*, dated April 2011, provides guidance in the measures and procedures that should be followed when handling lead-containing materials during construction projects. In the guideline, lead-containing construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of lead. Any operation that may expose a worker to lead that is not a Type 1, Type 2, or Type 3b operation, is classified as a Type 3a operation. Type 3a operations include, but are not limited to, for example, welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space and removal of lead-containing coatings or materials using power tools without an effective

⁽³⁾ *Lead-Containing Paints and Coatings: Preventing Exposure in the Construction Industry*. WorkSafe BC, 2011.

dust collection system equipped with a HEPA filter. Type 3b operations include abrasive blasting of lead-containing coatings or materials and removal of lead-containing dust using an air mist extraction system.

2.3 Mercury

Mercury has been used in electrical equipment such as alkaline batteries, fluorescent light bulbs (lamps), high intensity discharge (HID) lights (mercury vapour, high pressure sodium and metal halide), “silent switches” and in instruments such as thermometers, manometers and barometers, pressure gauges, float and level switches and flow meters. Mercury-containing lamps, the bulk of which are 1.22 m (four foot) fluorescent lamps contain between 7 and 40 mg of mercury each. Mercury compounds have also been used historically as additives in latex paint to protect the paint from mildew and bacteria during production and storage.

The intentional addition of mercury to Canadian-produced consumer paints for interior use was prohibited in 1991. Mercury may have remained in paints after 1991, however, as a result of impurities in the paint ingredients or cross-contamination due to other manufacturing processes. The Surface Coating Materials Regulations (SOR/2016-193) made pursuant to the Canada *Consumer Product Safety Act* states that a surface coating material must not contain more than 10 mg/kg mercury.

Mercury-containing thermostats and silent light switches are mercury tilt switches which are small tubes with electrical contacts at one end of the tube. A mercury tilt switch is usually present when no switch is visible. Mercury switches often have the word “TOP” stamped on the upper end of the switch, which is visible after removing the cover plate. If mercury switches are to be removed, the entire switch should be removed and placed into a suitable container for storage and disposal.

Waste light tubes generated during renovations or building demolition and waste mercury from equipment must either be recycled or disposed of in accordance with the requirements of Ont. Reg. 347 – *Waste Management, General*.

Waste mercury in amounts less than 5 kg (per month) are exempt from the generator registration requirements prescribed by O.Reg. 347 – *Waste Management – General*. Waste mercury from mercury switches or gauges should, however, be properly collected and shipped to a recycling facility or disposed of as a hazardous waste. Removal of mercury-containing equipment (e.g., switches, gauges, controls, etc.) should be carried out in a manner which prevents spillage and exposure to workers.

The Environment and Climate Change Canada (ECCC) document *Code of Practice for the Environmentally Sound Management of End-Of-Life Lamps Containing Mercury, February 2017* is a voluntary tool developed to complement provincial initiatives, and to promote best practices for managing end-of-life mercury-containing lamps.

2.4 Silica

Silica exists in several forms of which crystalline silica is of most concern with respect to potential worker exposures. Quartz is the most abundant type of crystalline silica. Some commonly used construction

materials containing silica include brick, refractory brick, concrete, concrete block, cement, mortar, rock and stone, sand, fill dirt, topsoil and asphalt containing rock or stone.

The Ontario Ministry of Labour *Guideline, Silica on Construction Projects*, dated April 2011, provides guidance in controlling exposure to silica dust during construction activities. In the guideline, silica-containing construction operations are classified into three groups – Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of respirable crystalline silica in the form of cristobalite, tridymite, quartz and tripoli.

2.5 Other Designated Substances

Vinyl chloride vapours may be released from polyvinyl chloride (PVC) products in the event of heating or as a result of decomposition during fire. PVC is used in numerous materials that may be found in building construction, including, for example, piping, conduits, siding, window and door frames, plastics, garden hoses, flooring and wire and cable protection.

Acrylonitrile is used to produce nitrile-butadiene rubber, acrylonitrile-butadiene-styrene (ABS) polymers and styrene-acrylonitrile (SAN) polymers. Products made with ABS resins which may be found in buildings include telephones, bottles, packaging, refrigerator door liners, plastic pipe, building panels and shower stalls. Acrylonitrile can be released into the air by combustion of products containing ABS.

Isocyanates are a class of chemicals used in the manufacture of certain types of plastics, foams, coatings and other products. Isocyanate-based building construction materials may include rigid foam products such as foam-core panels and spray-on insulation and paints, coatings, sealants and adhesives. Isocyanates may be inhaled if they are present in the air in the form of a vapour, a mist or a dust.

Benzene is a clear, highly flammable liquid used mainly in the manufacture of other chemicals. The commercial use of benzene as a solvent has practically been eliminated, however it continues to be used as a solvent and reactant in laboratories.

Arsenic is a heavy metal used historically in pesticides and herbicides. The primary use in building construction materials was its use in the wood preservative chromated copper arsenate (CCA). CCA was used to pressure treat lumber since the 1940s. Pressure-treated wood containing CCA is no longer being produced for use in most residential settings.

Ethylene oxide is a colourless gas at room temperature. It has been used primarily for the manufacture of other chemicals, as a fumigant and fungicide and for sterilization of hospital equipment.

Coke oven emissions are airborne contaminants emitted from coke ovens and are not a potential hazard associated with building construction materials.

2.6 PCBs

The management of equipment classified as waste and containing Polychlorinated Biphenyls (PCBs) at concentrations of 50 parts per million (mg/kg) or greater is regulated by *Ontario Regulation 362, Waste Management – PCBs*. Under this regulation, PCB waste is defined as any waste material containing PCBs in concentrations of 50 mg/kg or greater. Any equipment containing PCBs at or greater than this level, such as transformers, switchgear, light ballasts and capacitors, which is removed from service due to age, failure or as a result of decommissioning, is considered to constitute a PCB waste. Although current federal legislation (effective 1 July 1980) has prohibited the manufacture and sale of new equipment containing PCBs since that time, continued operation of equipment supplied prior to this date and containing PCBs is still permitted. Handling, storage and disposition of such equipment is, however, tightly regulated and must be managed in accordance with provincial and federal government requirements as soon as it is taken out of service or becomes unserviceable.

In most institutional, commercial facilities and in smaller industrial facilities, the primary source of equipment potentially containing PCBs is fluorescent and H.I.D. light ballasts. Small transformers may also be present. In larger industrial facilities, larger transformers and switch gear containing, or potentially containing, PCBs may also be present.

PCBs were also commonly added to industrial paints from the 1940s to the late 1970s. PCBs were added directly to the paint mixture to act as a fungicide, to increase durability and flexibility, to improve resistance to fires and to increase moisture resistance. The use of PCBs in new products was banned in Canada in the 1970s. PCB amended paints were used in specialty industrial/institutional applications prior to the 1970s including government buildings and equipment such as industrial plants, radar sites, ships as well as non-government rail cars, ships, grain bins, automobiles and appliances. PCB caulking was used in the 1950s and through the 1970s to seal the joints of brick, masonry, stone and metal window frames.

Removal of in-service equipment containing PCBs, such as fluorescent light ballasts, capacitors and transformers, is subject to the requirements of the federal *PCB Regulations* (discussed below).

The *PCB Regulations*, which came into force on 5 September 2008, were made under the *Canadian Environmental Protection Act*, 1999 (CEPA 1999) with the objective of addressing the risks posed by the use, storage and release to the environment of PCBs, and to accelerate their destruction. The *PCB Regulations* set different end-of-use deadlines for equipment containing PCBs at various concentration levels.

The Regulations Amending the PCB Regulations and Repealing the Federal Mobile PCB Treatment and Destruction Regulations were published on 23 April 2014, in the Canada Gazette, Part II, and came into force on 1 January 2015. The most notable part of the amendments is the addition of an end-of-use deadline date of 31 December 2025 for specific electrical equipment located at electrical generation, transmission and distribution facilities.

When the PCB materials are classified as waste, jurisdiction falls under the Ontario Ministry of the Environment and Climate Change (MOECC) and O.Reg. 362. All remedial and PCB management work

must be carried out under the terms of a Director's Instruction issued by an MOE District Office (for quantities of PCB fluid greater than 50 litres). The PCB waste stream, regardless of quantity, must be registered with the MOE, in accordance with O.Reg. 347, *General – Waste Management*. O.Reg. 362 applies to any equipment containing greater than 1 kg of PCBs.

2.7 Urea Formaldehyde Foam Insulation (UFFI)

Urea formaldehyde foam insulation (UFFI) is a polymer manufactured at point-of-use by blending urea formaldehyde resin with a phosphoric acid catalyst and compressed air at a nozzle tip. This nozzle was used to inject the freshly mixed foam product into enclosed wall cavities. UFFI was introduced in Canada in the 1970s. In response to concerns about the health effects of formaldehyde gas, the installation of UFFI was banned in Canada in 1980.

2.8 Ozone-Depleting Substances and Other Halocarbons

In Canada, the federal, provincial and territorial governments have legislation in place for the protection of the ozone layer and management of ozone-depleting substances and their halocarbon alternatives. The use and handling of these substances are regulated by the provinces and territories in their respective jurisdictions, and through the *Federal Halocarbon Regulations*, 2003 (FHR 2003) for refrigeration, air-conditioning, fire-extinguishing and solvent systems under federal jurisdiction.

The FHR 2003 were established in August 2003 and amended in July 2009 under the authority of the *Canadian Environmental Protection Act*, 1999. The purpose of the FHR 2003 is to reduce and prevent emissions of ozone-depleting substances and of their halocarbon alternatives to the environment from air-conditioning units, refrigeration, fire-extinguishing and solvent systems that are:

- located on federal or aboriginal lands; or
- owned by federal departments, board agencies, Crown corporations, or federal works and undertakings.

Ontario Regulation 347, *General – Waste Management*, has also been amended to provide for more strict control of CFCs. The requirements under the amended regulation apply primarily to the keeping of records for the receipt or recycling of CFC waste.

The FHR 2003 replaced the former Federal Halocarbon Regulations and incorporated new provisions to achieve an orderly transition from CFCs and Halons to alternative substances and technologies, reflecting *Canada's Strategy to Accelerate the Phase-Out of CFC and Halon Uses and to Dispose of the Surplus Stocks*.

Under the FHR 2003, a person who installs, services, leak tests, or charges a refrigeration system or an air conditioning system or does any other work on the system that may result in the release of a halocarbon must do so in accordance with the *Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems*.

Some of the requirements of FHR 2003 include:

- certification is required for all persons testing, repairing, filling or emptying equipment containing ozone-depleting substances and their halocarbon alternatives;
- no person shall store, transport or purchase a halocarbon unless it is in a container designed and manufactured to be refilled and to contain that specific type of halocarbon;
- before dismantling, decommissioning or destruction of any system, a person shall recover all halocarbons contained in the system into a container designed and manufactured to be refilled and to contain that specific type of halocarbon;
- before dismantling, decommissioning or destruction or destroying a system, a person shall affix a notice to the system containing information as required in Column 3, Item 1 of Schedule 2. This information includes the name and address of the owner of the system; name of the operator of the system, specific location of the system before its dismantling, decommissioning or destruction; description of the system; name of service technician who recovered the halocarbons; certificate number of the service technician (if applicable); name of employer of service technician (if applicable); type and quantity of halocarbon and date recovered; type and charging capacity of the system; and final destination of the system; and
- in the case of dismantling, decommissioning or destruction of any system, the owner shall keep a record of the information contained in the notice as described above.

2.9 Biological Hazards

2.9.1 Mould

Moulds are forms of fungi that are found everywhere both indoors and outdoors all year round. Outdoors, moulds live in the soil, on plants and on dead and decaying matter. More than 1000 different kinds of indoor moulds have been found in buildings. Moulds spread and reproduce by making spores, which are all small and light-weight, able to travel through air, capable of resisting dry, adverse environmental conditions, and hence capable of surviving a long time. Moulds need moisture and nutrients to grow and their growth is stimulated by warm, damp and humid conditions.

Control of exposure to mould is required under Section 25(2)(h) of the Ontario *Occupational Health and Safety Act*, which states that employers shall take every precaution reasonable in the circumstances for the protection of workers. Recommended work practices are outlined in the following documents:

- *Mould Guidelines for the Canadian Construction Industry*. Standard Construction Document CCA 82 2004. Canadian Construction Association.
- *Mould Abatement Guidelines*. Environmental Abatement Council of Ontario. Edition 3. 2015.

2.9.2 Animal Droppings

Histoplasmosis is an infectious disease caused by inhaling the spores of a fungus called *Histoplasma capsulatum*. Histoplasmosis primarily affects a person's lungs, and its symptoms vary greatly. Histoplasmosis can appear as a mild, flu-like respiratory illness and has a combination of symptoms,

including malaise (a general ill feeling), fever, chest pain, dry or non productive cough, headache, loss of appetite, shortness of breath, joint and muscle pains, chills, and hoarseness. Chronic lung disease due to histoplasmosis resembles tuberculosis and can worsen over months or years. ⁴

H capsulatum grows in soils throughout the world. The fungus seems to grow best in soils having a high nitrogen content, especially those enriched with bird manure or bat droppings. The organism can be carried on the wings, feet and beaks of birds and infect soil under roosting sites or manure accumulations inside or outside buildings. Active and inactive roosts of blackbirds have been found heavily contaminated by *H capsulatum*. On the other hand, fresh bird droppings on surfaces such as sidewalks and window sills have not been shown to present a health risk for histoplasmosis because birds themselves do not appear to be infected by *H capsulatum*. Rather, bird manure is primarily a nutrient source for the growth of *H capsulatum* already present in the soil. Unlike birds, bats can become infected with *H capsulatum* and consequently can excrete the organism in their droppings.

In addition to *H capsulatum*, inhalation exposure to *Cryptococcus neoformans* may also be a health risk for workers in environments containing accumulations of bat droppings or bird manure. *C neoformans* is the infectious agent of the fungal disease cryptococcosis. Formerly a rare disease, the incidence of cryptococcosis has increased in recent years because of its frequent occurrence in AIDS patients. *C neoformans* and *H capsulatum* are only two of the more than 100 microorganisms that have been reported with increased frequency among HIV-infected persons, and cryptococcosis and histoplasmosis are both classified as AIDS-indicator opportunistic infectious diseases.

2.9.3 Raccoon Feces

A roundworm commonly known as Raccoon Roundworm (*Baylisascaris*) lives in the digestive tracts of raccoons, and can potentially cause a serious infection in humans if infected roundworm eggs in soil, water or an object that has been contaminated with raccoon feces are accidentally ingested.

2.9.4 Mouse Droppings

Hantaviruses are found in the droppings, urine and saliva of infected rodents and humans can contract the virus from breathing in airborne particles or from being bitten. In Canada, a hantavirus capable of causing disease in humans – named Sin Nombre virus – has been identified in deer mice. Although the risk in Canada is low, when it happens, the disease can be very severe.

Exposure to hantaviruses can cause a rare, but often fatal, disease called Hantavirus pulmonary syndrome (HPS). The earliest documented case of HPS in Canada was contracted in Alberta in 1989. Since then,

⁴ *Histoplasmosis — Protecting Workers at Risk*, Revised Edition, United States Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH), December 2004.

there have been over 70 confirmed cases. Most of the cases occurred in western Canada (Manitoba, Saskatchewan, Alberta and British Columbia), except for one case in Quebec.⁵

Hantavirus is typically transmitted by breathing particles in air from the droppings, urine and saliva of infected rodents. However, there have been a small number of reported cases of HPS believed to have been contracted through rodent bites.

⁵ Health Canada – “It’s Your Health – Hantaviruses” – August 2009.

3 METHODOLOGY

All areas of the building were surveyed, with the exception of the roof.

Arcadis reviewed the Maple Environmental Inc. report entitled *Designated Substance and Detailed Asbestos Building Materials Survey Report*, dated March 2011 in preparing this report.

3.1 Asbestos

Bulk sampling was performed in accordance with the requirements of O. Reg. 278/05 as follows:

- the minimum number of bulk samples to be collected from an area of homogeneous material is set out in Table 1 of the regulation (Table 3.1 is reproduced below).
- if analysis establishes that a bulk material sample contains 0.5 per cent or more asbestos by dry weight:
 - (a) it is not necessary to analyze other bulk material samples taken from the same area of homogeneous material; and
 - (b) the entire area of homogeneous material from which the bulk materials sample was taken is deemed to be asbestos-containing material.

Table 3.1 Bulk Material Samples (From O.Reg. 278/05)

Item	Type of Material	Size of Area of Homogeneous Material	Minimum Number of Bulk Material Samples to be Collected
1	Surfacing material, including without limitation material that is applied to surfaces by spraying, by trowelling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members	Less than 90 square metres	3
		90 or more square metres, but less than 450 square metres	5
		450 or more square metres	7
2	Thermal insulation, except as described in Item 3	Any size	3
3	Thermal insulation patch	Less than 2 linear metres or 0.5 square metres	1
4	Other material	Any size	3

These Ontario Regulation 278/05 minimum bulk sample number requirements are consistent with the bulk sampling requirements specified in the DND Asbestos Management Directive.

In practice, application of the Table 3.1 requirements means that the specified minimum number of negative (i.e., less than 0.5% asbestos) bulk sample analysis results will be required in order to classify a material as non-asbestos. Area of homogeneous material means an area in a building constructed at the same time. Homogeneous material is defined as material that is uniform in colour and texture.

Bulk sampling was “non-destructive”, therefore certain materials including but not limited to, ceramic tile grout and mortar beds, were only sampled from areas of existing damage, if any.

Analysis of bulk samples was performed following EPA Method 600/R-93/116 in conformity with the requirements specified in O. Reg. 278/05. A “stop positive” protocol was utilized whereby one positive (more than 0.5%) sample result from a homogeneous area can be considered evidence that all suspect material in that homogeneous area contains asbestos without analysing the remaining samples.

The “*Asbestos Condition Assessment and Response Chart*” in the DND Asbestos Management Directive was used in identifying required response actions. A copy of the Chart is provided in Appendix E.

3.2 Lead

Samples of select, representative paint applications collected during the course of the site inspection were forwarded to ALS Environmental Inc. for analysis of lead content.

Information on paint sample location, substrate material, sample description and other locations with the same paint application was recorded and reported in Tables 4.2 and 4.3.

3.3 Mercury

The presence of equipment which may contain mercury, such as fluorescent light tubes, thermometers, gauges, etc. observed during the course of our site inspection was recorded.

Paint samples, discussed above in Section 3.2, were also analysed for mercury.

3.4 Silica

The presence of silica-containing materials observed during the course of our site inspection was documented. Silica is known to be a constituent of brick, concrete, cement, etc. Sampling and laboratory analysis are not required to make this determination.

3.5 Other Designated Substances and Hazardous Materials

Paint samples were collected for analysis of arsenic and chromium.

3.6 PCBs

Fluorescent lights were inspected during the course of our survey to determine whether they were the T12 type and may therefore contain PCB ballasts.

Transformers were investigated to determine whether they were the “dry” type which do not contain PCB dielectric fluids, or the “wet” type which can contain PCBs.

Paint samples were collected for analysis of PCBs.

3.7 Urea Formaldehyde Foam Insulation

Investigations for the potential presence of UFFI entailed inspection of exterior and interior openings (i.e., “nozzle holes”) made for installation of insulation and limited visual observation of the wall cavity and insulating materials at select, representative locations.

3.8 Ozone-Depleting Substances and Other Halocarbons

The presence of Ozone Depleting Substances (ODSs) and other Halocarbons was reviewed within the building and recorded.

3.9 Biological Hazards

The presence of “suspect” mould observed during the course of our site inspection was documented. “Suspect” mould is typically a coloured, textured substance or discolouration or staining on a building material surface which, based on our experience, may be mould growth. The adjective “suspect” is used where the presence of mould has not been confirmed by laboratory analysis.

The inspection of mould was limited to visual observations of readily accessible surfaces and did not include intrusive inspections of wall cavities.

The presence of any animal droppings observed was also noted.

4 DISCUSSIONS AND SUMMARY OF RESULTS

4.1 Asbestos

The results of the bulk sample analyses for asbestos content are provided in Appendix C, and the laboratory report is provided in Appendix B. Sample locations are shown on the floor plans provided in Appendix A. A summary of building materials sampled and found not to contain asbestos is presented in Table 4.1.

Photographs are presented in Appendix D.

Potential asbestos-containing materials are materials which could contain asbestos, but which were not sampled as such sampling could cause significant damage. Potential asbestos-containing materials observed at this site include boiler insulation, mortar beds and grout under ceramic floor tiles, exterior window caulking and roofing materials.

Areas where potential asbestos-containing materials were observed are as follows:

- Mechanical Room – insulation inside the boiler; and
- Rooms 106, 107, 108 and 124 – ceramic tile grout and mortar beds.

Other potential asbestos-containing materials may also be present. A list of possible asbestos-containing materials in buildings from the Ministry of Labour “Sample List of Suspect Asbestos-Containing Materials” is provided in Appendix F.

Asbestos was not detected in any of the samples collected by Arcadis or Maple Environmental Inc.

Table 4.1 Summary of Materials Sampled and Confirmed to be Non-Asbestos-Containing – Building A - 243

Material	Substrate	Sample Locations
2'x4' ceiling tile – pinhole and medium fissures	N/A	Room 105, Room 103 and Room 102
Vinyl baseboard – turquoise	Concrete block and drywall	Room 102, Room 103 and Room 105
Turquoise vinyl baseboard mastic	Concrete block	Room 102, Room 103 and Room 105
Stone mortar	Concrete block	Corridor 1 and Corridor 2
Vinyl baseboard – beige	Concrete block	Corridor 1 and Corridor 2
Beige vinyl baseboard – mastic	Concrete block	Corridor 1 and Corridor 2
Drywall joint compound	Drywall	Room 105, Room 114, Room 123, Corridor 3, Room 103 and Room 205
Vinyl sheet flooring – turquoise	Concrete	Room 105, Corridor 1 and Corridor 2
Vinyl sheet flooring – beige	Concrete	Corridor 1, Corridor 2 and Corridor 3
Block filler paint	Concrete block wall	Room 114, Room 125, Room 116, Room 109, Stair 1, Electrical Room and Boiler Room
Concrete block mortar	Concrete block	Room 109, Room 110 and Stairwell 1
Door frame caulking – white	Concrete block	Corridor 1, Corridor 2 and Room 114
Vinyl sheet flooring – black	Concrete	Room 123 and Room 124
Black vinyl sheet flooring mastic	Concrete	Room 123
2'x4' ceiling tile – pinhole and long fissure	N/A	Room 123
Window glazing	Metal	Room 123
12" vinyl floor tile – white with black flecks	Wood	Room 205
12" vinyl floor tile mastic – white with black flecks	Wood	Room 205
Parging cement	Concrete	Exterior

Based on visual observations, and results of laboratory analyses of samples collected by Arcadis asbestos-containing materials (ACM) were not found to be present in the subject building.

Glass fibre pipe insulation is readily visually distinguishable (typically yellow in colour) from asbestos-containing insulation materials and was, therefore, not tested for asbestos content.

Asbestos may be present in materials which were not sampled during the course of the designated substances survey carried out by Arcadis, including, but not limited to, roofing materials, materials inside the boiler, ceramic tile grout and mortar beds, components of electrical equipment, for example, electric wiring insulation, non-metallic sheathed cable, electrical panel partitions, arc chutes, high-grade electrical paper. The major use of asbestos electrical paper is insulation for high temperature, low voltage applications such as in motors, generators, transformers, switch gears and other heavy electrical apparatuses. Asbestos may also be present in locations that are presently inaccessible (e.g., above solid ceilings, behind walls). Asbestos may also be present in the form of vermiculite insulation in cavities in concrete or cement block walls (used as fill-in insulation). Confirmatory testing of any such materials could

be undertaken as the need arises (ie., at the time of renovations) or the material can be assumed to contain asbestos based on the findings in adjacent areas.

4.2 Lead

Samples of representative paint were collected by Arcadis during the course of the survey. The samples were submitted to ALS for analysis of lead (as well as mercury, arsenic, chromium and PCBs). The results of analysis are presented in Table 4.2 and photographs of paint applications are presented in Appendix D.

Lead was not detected at a level above 90 µg/g (Surface Coating Materials Regulations SOR/2016-193 criterion value) in all of the paint samples analysed. Lead may be present in lead pipe, in the solder on the seals of bell joints of any cast iron drainpipe and in the solder on the sweated-on joints between copper pipe and fittings.

Paint applications were observed to be in good condition.

Table 4.2 Surface Coating – Sampling Summary – Building A - 243

Sample ID	Sample Location	Substrate Material	Sample Description	Condition	Analytical Results (µg/g)				
					Arsenic (10 µg/g*)	Chromium (500 µg/g*)	Lead (90 µg/g^)	Mercury (10 µg/g^)	PCBs (50 µg/g")
P-1 (Photo 14)	Room 109	Block wall	White wall paint	Good	<1.0	14.3	4.7	0.071	0.14
P-2 (Photo 27)	Room 114	Drywall	White wall paint	Good	<1.0	19.9	7.6	<0.050	<2.6
P-3 (Photo 25)	Exterior	Metal	Light blue door paint	Good	<1.0	12.3	16.7	0.155	<3.0

< = Less than.

Analytical Results: *No current regulated amounts for arsenic and chromium. Numbers taken from SOW Appendix E. Any concentration above stated numbers. ^SOR/2005-109 Surface Coating Materials Regulations, "SOR/2008-273 PCB Regulation.

Bolded areas indicate elevated levels of contaminants. Use Caution. Follow MOL Guideline for Lead, wet surfaces down before disturbing them. Notify Base Environmental Officer of the need to dispose of contaminated paint prior to disturbing it.

Table 4.3 Summary of Rooms with Similar Surface Coatings – Building A - 243

Paint Description	Rooms with Similar Surface Coating/Paint Colour
P-1/ White wall paint	Rooms 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 121, 122, 123, 124, 125, 203, 204, Corridor 2, Corridor 3, Stairwell 1, POL Shed and Mechanical Room
P-2/ White wall paint	Rooms 101, 102, 103, 105, 109, 112, 113, 114, 122 and 123
P-3/ Blue door paint	Exterior

4.3 Mercury

During the course of our site inspections, fluorescent lights were observed throughout the buildings. Mercury should be assumed to be present as a gas in all fluorescent light tubes.

Proper procedures for removing and handling mercury-containing fluorescent light tubes typically involve:

- ensuring that electrical power to light fixtures has been disconnected and locked out;
- taking all necessary precautions to ensure that fluorescent lamp tubes are removed in a manner that prevents breakage; and
- transporting fluorescent lamp tubes to a licensed processing location for separation and recovery of mercury.

Samples of paint collected during the survey were analysed for mercury. The results of analysis are presented in Table 4.2. Mercury was not detected at a level above 10 µg/g (Surface Coating Materials Regulations SOR/2016/193 criterion value) in any of the paint samples analysed.

4.4 Silica

Materials observed in the subject building which should be considered to contain silica included concrete, concrete blocks, brick, mortar, drywall, drywall joint compound, ceramic floor tile grout and mortar beds.

4.5 Other Designated Substances and Hazardous Materials

No other designated substances (vinyl chloride, acrylonitrile, benzene, isocyanates, ethylene oxide and coke oven emissions) were observed to be present in the subject building, and none would be expected to be encountered in any building materials in a form that would represent an exposure concern.

Samples of paint collected during the survey were analysed for arsenic and chromium. The results of analysis are presented in Table 4.2.

Arsenic was not detected at an amount above the level of 10 µg/g in any of the paint samples analysed.

Chromium was not detected at an amount above the level of 500 µg/g in any of the paint samples analysed.

4.6 PCBs

Light ballasts, such as those associated with the type of fluorescent lights (T8s) observed throughout the building, are usually an electronic-type which do not contain PCBs, however, this would be confirmed by an electrician at the time of dismantling of the lights.

Light ballasts, such as those associated with the type of fluorescent lights (T12s) identified in Room 203 are typically a magnetic type which may contain PCBs. Inspection of product codes and date codes on the ballasts can be used to determine the likely presence or absence of PCBs.

PCBs were not detected at a level above the criterion level of 50 µg/g in any of the three paint samples analysed.

No transformers were observed in the building.

4.7 Urea Formaldehyde Foam Insulation (UFFI)

UFFI was not observed during the course of the investigation.

4.8 Ozone-Depleting Substances and Other Halocarbons

During the course of our site inspections, equipment potentially containing Ozone-Depleting Substances and other Halocarbons included:

- Wall-mounted air conditioner in Room 101;
- Window mounted air conditioners in Rooms 102 and 105;
- Drink fridge in Room 202;
- Mini-fridge in Room 102, and
- Ceiling-mounted air conditioners in Room 205.

4.9 Biological Hazards

No animal droppings were observed during the site investigation.

Suspect mould growth was observed on the 2'x4' ceiling tiles in Room 205.

The investigation of mould was limited to visual observations of readily accessible surfaces and did not include intrusive investigations of wall cavities.

5 CONCLUSIONS AND RECOMMENDATIONS

We recommend the following on the basis of the findings of the designated substances survey outlined in this report.

5.1 Ongoing Management

1. If any potential asbestos-containing materials that have not been tested for asbestos may be affected by maintenance or other work activities, they should be tested prior to their disturbance or assumed to contain asbestos and handled accordingly.
2. If work activities may cause exposure to metallic elements in paint, develop an exposure control plan, write safe work procedures and implement controls.
3. If work activities may cause exposure to metallic elements in paint, develop an exposure control plan, write safe work procedures and implement controls in accordance with MOL *Guideline – Lead on Construction Projects*.
4. If silica-containing materials will be affected by sanding, drilling, chipping, grinding, cutting, sawing, sweeping or blasting, the measures and procedures outlined in the Ontario Ministry of Labour *Guideline, Silica on Construction Projects*, April 2011, should be followed.
5. Comply with the requirements of FHR 2003 when installing, servicing, testing, charging or doing any other work on a refrigeration system or an air conditioning system that may result in the release of a halocarbon.

5.2 Construction Projects

1. If there are any materials which may contain asbestos and which were not tested during the course of the hazardous building materials survey, and which may be disturbed during construction activities, a “destructive” survey may be required to access and sample potential asbestos-containing materials not sampled.
2. If asbestos-containing materials are found to be present and will be affected by any construction and/or demolition work, they must be removed/handled in accordance with work practices and procedures specified in Ontario Regulation 278/05 and the DND Asbestos Management Directive. Requirements for air sampling for asbestos fibres during and upon completion of asbestos abatement operations are prescribed in the Canada Occupational Health and Safety Regulations made under the Canada Labour Code.
3. If lead-containing materials will be disturbed during the course of construction work, the measures and procedures outlined in The Ministry of Labour Guideline, Lead on Construction Projects, dated April 2011, should be followed. For building materials that are to be disposed at a landfill, all painted waste materials and associated substrate (concrete, plaster, wood, etc.) must undergo Toxicity Characteristic Leachate Properties (TCLP) testing to determine disposal procedures. The acceptable level for non-regulated disposal of lead-containing waste is less than 5 mg/L as

determined through analytical TCLP. The disposal of lead-containing waste is regulated under the Federal *Transportation of Dangerous Goods Act* and by the Ontario Ministry of Environment and Climate Change.

4. TCLP testing will also be required for arsenic, chromium and mercury. The acceptable levels for non-regulated disposal of waste containing arsenic, chromium and mercury are 5.0 mg/L, 8.0 mg/L and 0.2 mg/L, respectively.
5. If silica-containing materials will be disturbed during the course of construction work, the measures and procedures outlined The Ministry of Labour *Guideline, Silica on Construction Projects*, April 2011, should be followed.
6. If any fluorescent light tubes are removed, the light tubes should be recycled for mercury. The Environmental and Climate Change Canada (ECCC) document *Code of Practice for the Environmentally Sound Management of End-of-Life Lamps Containing Mercury*, February 2017 provides guidance for managing end-of-life mercury-containing lamps.
7. Prior to undertaking renovation activities that involve fluorescent lights, ensure that a licensed electrician inspects ballasts to determine whether or not any light ballasts may contain PCBs. Guidance in identification of PCB ballasts is provided in the Environment Canada publication titled "Identification of Lamp Ballasts Containing PCBs. Report EPS 2/CC/2 (revised)", August 1991.
8. Workers involved in the demolition of any mould-impacted materials encountered during any renovation or demolition activities should wear appropriate protective clothing and equipment and follow decontamination practices as outlined in the Canadian Construction Association Standard Construction Document CCA-82 2004 – *Mould Guidelines for the Canadian Construction Industry*, and the Mould Abatement Guidelines. Environmental Abatement Council of Ontario. Edition 3. 2015.
9. If caulking will be impacted by planned construction work, it should be tested for PCBs prior to commencement of the work.

6 LIMITATIONS AND SERVICE CONSTRAINTS

The opinions, conclusions and recommendations presented in this report are limited to the information obtained during the performance of the specific scope of service identified in the report. To the extent that Arcadis relied upon any information prepared by other parties not under direct contract to Arcadis, no representation as to the accuracy or completeness of such information is made. This report is an instrument of professional service and the services described in the report were performed in accordance with generally accepted standards and level of skill and care ordinarily exercised by members of the profession working under similar conditions including comparable budgetary and schedule constraints. No warranty, guarantee or certification express or implied, is intended or given with respect to Arcadis' services, opinions, conclusions or recommendations.

Arcadis' observations, the results of any testing and Arcadis' opinions, conclusions and recommendations apply solely to conditions existing at the specific times when and specific locations where Arcadis' investigative work was performed. Arcadis affirms that data gathered and presented in this report was collected in an appropriate manner in accordance with generally accepted methods and practices. Arcadis cannot be responsible for decisions made by our client solely on the basis of economic factors. Observation and testing activities such as those conducted by Arcadis are inherently limited and do not represent a conclusive or complete characterization. Arcadis analyzed only the substances, conditions and locations described in the report at the time indicated. Conditions in other parts of the project site, building or area may vary from conditions at the specific locations where observations were made and where testing was performed by Arcadis. Additionally, other building material hazards which were not identified by Arcadis, may also be present in un-accessed areas and in walls, ceilings, cavities, and floors.

This report is expressly for the sole and exclusive use of Defence Construction Canada (DCC) for whom this report was originally prepared and for the particular purpose outlined in the report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk. This report must be presented in its entirety.

7 REFERENCES

Relevant documents referenced for this project included:


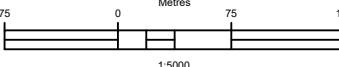
- The DCC Statement of Work dated May 20, 2021;
- Arcadis proposal to DCC dated July 19, 2021; and
- Department of National Defence (DND) Asbestos Management Directive, March 2007.

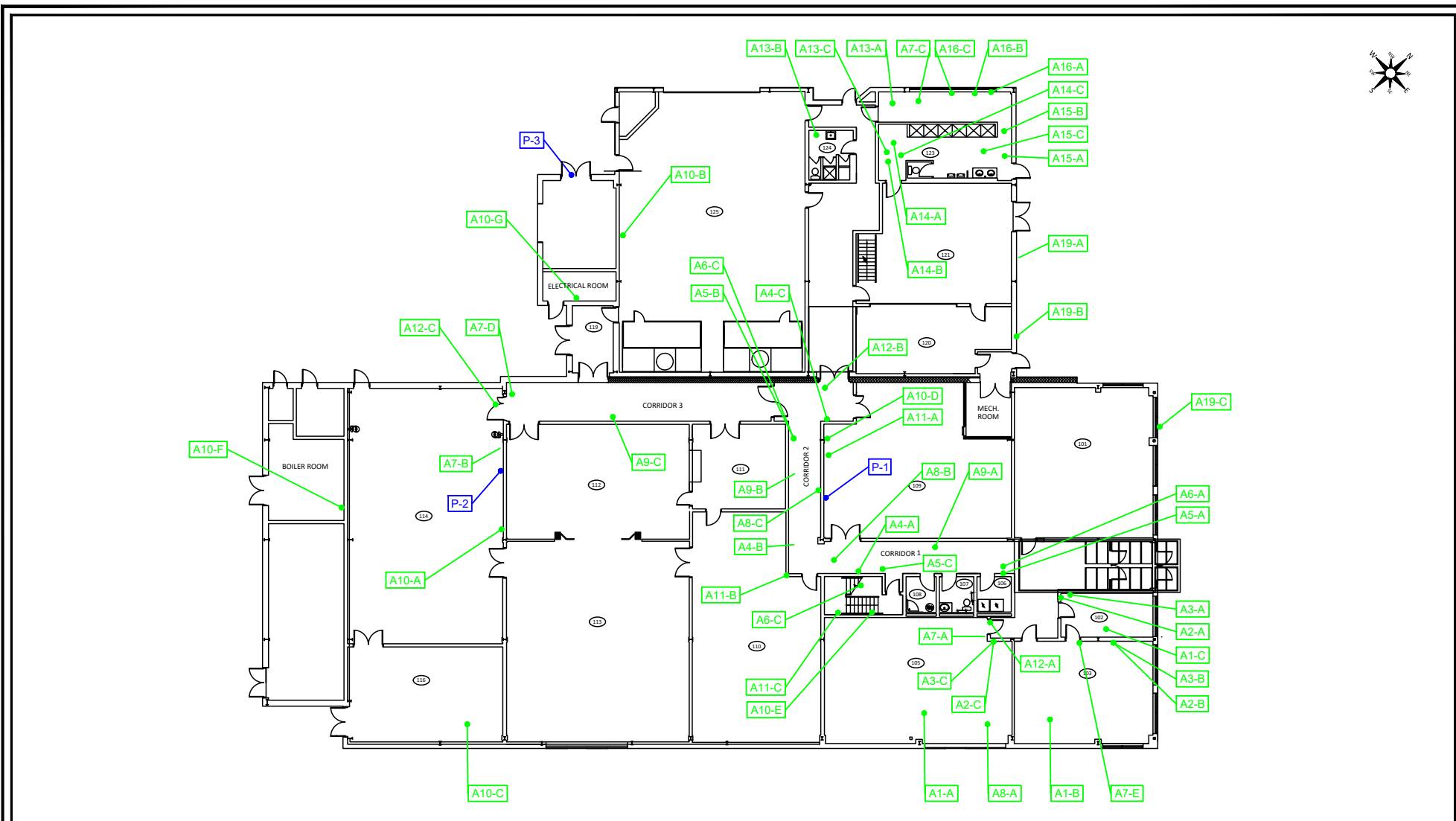
APPENDIX A

Floor Plans



LEGEND

Title: SITE LOCATION	
	Project: DESIGNATED SUBSTANCES SURVEY BLDG A243 17 HANGAR ROAD, BORDEN, ONTARIO
	Client: DEFENCE CONSTRUCTION CANADA
Date: January 2022	
	
FIGURE 1	



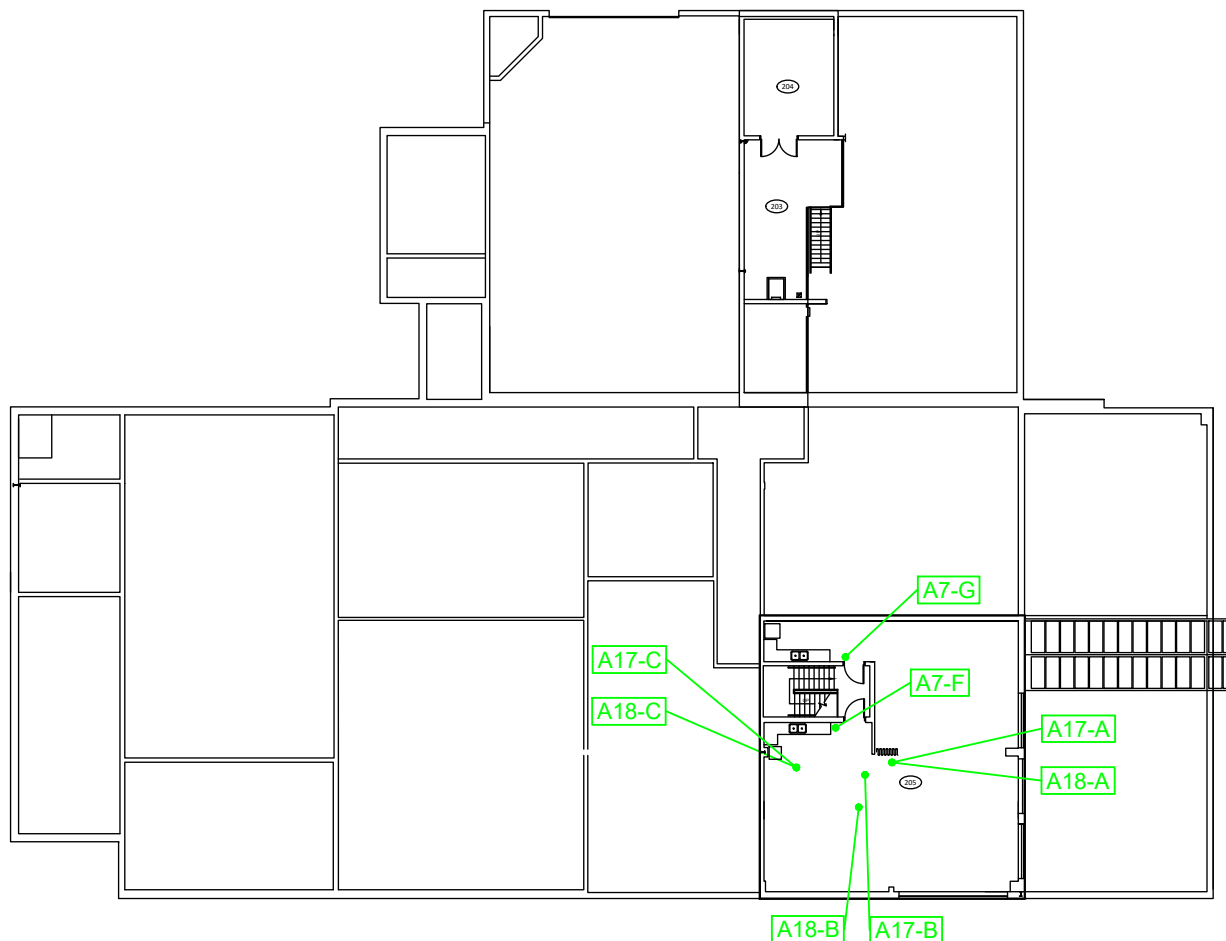
LEGEND

- 103 FUNCTIONAL SPACE
- A1-A BULK ASBESTOS SAMPLE LOCATIONS
- P-1 BULK PAINT SAMPLE LOCATIONS




NOTE:
Potential asbestos-containing materials observed at this site include ceramic tiles mortar bed and grout, roofing materials, Boiler insulation and exterior window caulking.

last saved 26-Jan-22 by dlogan

Title: FIRST FLOOR	
	Project: DESIGNATED SUBSTANCES SURVEY BLDG A243 17 HANGAR ROAD, BORDEN, ONTARIO
Date: January 2022	Client: DEFENCE CONSTRUCTION CANADA
<div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 10px;">2</div> <div style="margin-right: 10px;">0</div> <div style="margin-right: 10px;">2</div> <div style="margin-right: 10px;">4</div> </div> <div style="display: flex; align-items: center; justify-content: center;"> <div style="width: 100px; border-bottom: 1px solid black; position: relative;"> <div style="position: absolute; left: 0; top: -5px;">2</div> <div style="position: absolute; right: 0; top: -5px;">4</div> </div> <div style="margin: 0 5px;">Metres</div> <div style="width: 100px; border-bottom: 1px solid black; position: relative;"> <div style="position: absolute; left: 0; top: -5px;">2</div> <div style="position: absolute; right: 0; top: -5px;">4</div> </div> </div> <div style="display: flex; align-items: center; justify-content: center; font-size: 0.8em;"> 1:140 </div>	
FIGURE 2	



LEGEND

-  FUNCTIONAL SPACE
-  BULK ASBESTOS SAMPLE LOCATIONS
-  BULK PAINT SAMPLE LOCATIONS

NOTE:
Potential asbestos-containing materials observed at this site include ceramic tiles mortar bed and grout, roofing materials, Boiler insulation and exterior window caulking.

Title:

SECOND FLOOR



Project:

**DESIGNATED SUBSTANCES SURVEY
BLDG A243
17 HANGAR ROAD, BORDEN, ONTARIO**

Date:

January 2022

Client:

DEFENCE CONSTRUCTION CANADA

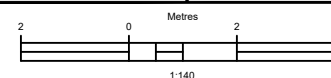


FIGURE 3

APPENDIX B

Laboratory Reports



EMSL Canada Inc.

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<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 552117361
 Customer ID: 55DCSL97
 Customer PO: 30094312
 Project ID:

Attn: Viraj Daruwala
 ARCADIS Canada Inc.
 121 Granton Drive
 Unit 12
 Richmond Hill, ON L4B 3N4
Proj: 30094312 - CFB Building

Phone: (905) 882-5984
Fax: (905) 882-8962
Collected:
Received: 10/21/2021
Analyzed: 10/29/2021

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A1-A **Lab Sample ID:** 552117361-0001

Sample Description: 105/2'x4' ceiling tile – pinhole and medium fissures

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray/White	70.0%	30.0%	None Detected	

Client Sample ID: A1-B **Lab Sample ID:** 552117361-0002

Sample Description: 103/2'x4' ceiling tile – pinhole and medium fissures

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray/White	70.0%	30.0%	None Detected	

Client Sample ID: A1-C **Lab Sample ID:** 552117361-0003

Sample Description: 102/2'x4' ceiling tile – pinhole and medium fissures

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Gray/White	70.0%	30.0%	None Detected	

Client Sample ID: A2-A **Lab Sample ID:** 552117361-0004

Sample Description: 102/Vinyl baseboard – turquoise

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	10/28/2021	Green	0.0%	100.0%	None Detected	

Client Sample ID: A2-B **Lab Sample ID:** 552117361-0005

Sample Description: 103/Vinyl baseboard – turquoise

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Green	0.0%	100.0%	None Detected	

Client Sample ID: A2-C **Lab Sample ID:** 552117361-0006

Sample Description: 105/Vinyl baseboard – turquoise

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Green	0.0%	100.0%	None Detected	

Client Sample ID: A3-A **Lab Sample ID:** 552117361-0007

Sample Description: 102/Turquoise vinyl baseboard mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Yellow	0.0%	100.0%	None Detected	



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<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 552117361
Customer ID: 55DCSL97
Customer PO: 30094312
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A3-B **Lab Sample ID:** 552117361-0008
Sample Description: 103/Turquoise vinyl baseboard mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A3-C **Lab Sample ID:** 552117361-0009
Sample Description: 105/Turquoise vinyl baseboard mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A4-A **Lab Sample ID:** 552117361-0010
Sample Description: Cor 1/Stone mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A4-B **Lab Sample ID:** 552117361-0011
Sample Description: Cor 2/Stone mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A4-C **Lab Sample ID:** 552117361-0012
Sample Description: Cor 2/Stone mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A5-A **Lab Sample ID:** 552117361-0013
Sample Description: Cor 1/Vinyl baseboard – beige

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	10/28/2021	Beige	0.0%	100.0%	None Detected	

Client Sample ID: A5-B **Lab Sample ID:** 552117361-0014
Sample Description: Cor 2/Vinyl baseboard – beige

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Beige	0.0%	100.0%	None Detected	

Client Sample ID: A5-C **Lab Sample ID:** 552117361-0015
Sample Description: Cor 1/Vinyl baseboard – beige

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Beige	0.0%	100.0%	None Detected	



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<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 552117361
Customer ID: 55DCSL97
Customer PO: 30094312
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A6-A **Lab Sample ID:** 552117361-0016

Sample Description: Cor 1/Beige vinyl baseboard mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A6-B **Lab Sample ID:** 552117361-0017

Sample Description: Cor 2/Beige vinyl baseboard mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021				Insufficient Material	Sample bag is empty.

Client Sample ID: A6-C **Lab Sample ID:** 552117361-0018

Sample Description: Cor 1/Beige vinyl baseboard mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A7-A **Lab Sample ID:** 552117361-0019

Sample Description: 105/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A7-B **Lab Sample ID:** 552117361-0020

Sample Description: 114/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A7-C **Lab Sample ID:** 552117361-0021

Sample Description: 123/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A7-D **Lab Sample ID:** 552117361-0022

Sample Description: Cor 3/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A7-E **Lab Sample ID:** 552117361-0023

Sample Description: 103/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	



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EMSL Canada Order 552117361
 Customer ID: 55DCSL97
 Customer PO: 30094312
 Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A7-F **Lab Sample ID:** 552117361-0024
Sample Description: 205/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A7-G **Lab Sample ID:** 552117361-0025
Sample Description: 205/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A8-A **Lab Sample ID:** 552117361-0026
Sample Description: 105/Vinyl sheet flooring – turquoise

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	10/28/2021	Green	0.0%	100.0%	None Detected	

Client Sample ID: A8-B **Lab Sample ID:** 552117361-0027
Sample Description: Cor 1/Vinyl sheet flooring – turquoise

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Blue/Green	0.0%	100.0%	None Detected	

Client Sample ID: A8-C **Lab Sample ID:** 552117361-0028
Sample Description: Cor 2/Vinyl sheet flooring – turquoise

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Blue/Green	0.0%	100.0%	None Detected	

Client Sample ID: A9-A **Lab Sample ID:** 552117361-0029
Sample Description: Cor 1/Vinyl sheet flooring – beige

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	10/28/2021	Beige	0.0%	100.0%	None Detected	

Client Sample ID: A9-B **Lab Sample ID:** 552117361-0030
Sample Description: Cor 2/Vinyl sheet flooring – beige

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Beige	0.0%	100.0%	None Detected	

Client Sample ID: A9-C **Lab Sample ID:** 552117361-0031
Sample Description: Cor 3/Vinyl sheet flooring – beige

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Beige	0.0%	100.0%	None Detected	



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EMSL Canada Order 552117361
Customer ID: 55DCSL97
Customer PO: 30094312
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A10-A **Lab Sample ID:** 552117361-0032
Sample Description: 114/Block filler paint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A10-B **Lab Sample ID:** 552117361-0033
Sample Description: 125/Block filler paint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A10-C **Lab Sample ID:** 552117361-0034
Sample Description: 116/Block filler paint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A10-D **Lab Sample ID:** 552117361-0035
Sample Description: 109/Block filler paint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A10-E **Lab Sample ID:** 552117361-0036
Sample Description: Stair 1/Block filler paint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A10-F **Lab Sample ID:** 552117361-0037
Sample Description: Boiler room/Block filler paint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A10-G **Lab Sample ID:** 552117361-0038
Sample Description: Electrical room/Block filler paint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A11-A **Lab Sample ID:** 552117361-0039
Sample Description: 109/Concrete block mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray	0.0%	100.0%	None Detected	



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 Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A11-B **Lab Sample ID:** 552117361-0040
Sample Description: 110/Concrete block mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A11-C **Lab Sample ID:** 552117361-0041
Sample Description: Stair 1/Concrete block mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A12-A **Lab Sample ID:** 552117361-0042
Sample Description: Cor 1/Door frame caulking - white

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	White	0.0%	100%	None Detected	
TEM Grav. Reduction	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A12-B **Lab Sample ID:** 552117361-0043
Sample Description: Cor 2/Door frame caulking – white

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A12-C **Lab Sample ID:** 552117361-0044
Sample Description: 114/Door frame caulking – white

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	White	0.0%	100.0%	None Detected	

Client Sample ID: A13-A **Lab Sample ID:** 552117361-0045
Sample Description: 123/Vinyl sheet flooring – black

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	Green	2.6%	97.4%	None Detected	
TEM Grav. Reduction	10/28/2021	Green	0.0%	100.0%	None Detected	

Client Sample ID: A13-B **Lab Sample ID:** 552117361-0046
Sample Description: 124/Vinyl sheet flooring – black

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray/Black	<1%	100.0%	None Detected	

Client Sample ID: A13-C **Lab Sample ID:** 552117361-0047
Sample Description: 123/Vinyl sheet flooring – black

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Green	2.0%	98.0%	None Detected	



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Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A14-A **Lab Sample ID:** 552117361-0048
Sample Description: 123/Black vinyl sheet flooring mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A14-B **Lab Sample ID:** 552117361-0049
Sample Description: 123/Black vinyl sheet flooring mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A14-C **Lab Sample ID:** 552117361-0050
Sample Description: 123/Black vinyl sheet flooring mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A15-A **Lab Sample ID:** 552117361-0051
Sample Description: 123/2'x4' ceiling tile- pinholes and long fissures

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray/White	70.0%	30.0%	None Detected	

Client Sample ID: A15-B **Lab Sample ID:** 552117361-0052
Sample Description: 123/2'x4' ceiling tile- pinholes and long fissures

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray/White	70.0%	30.0%	None Detected	

Client Sample ID: A15-C **Lab Sample ID:** 552117361-0053
Sample Description: 123/2'x4' ceiling tile- pinholes and long fissures

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Gray/White	60.0%	40.0%	None Detected	

Client Sample ID: A16-A **Lab Sample ID:** 552117361-0054
Sample Description: 123/Window glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	10/28/2021	Black	0.0%	100.0%	None Detected	

Client Sample ID: A16-B **Lab Sample ID:** 552117361-0055
Sample Description: 123/Window glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray	0.0%	100.0%	None Detected	



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Customer ID: 55DCSL97
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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A16-C **Lab Sample ID:** 552117361-0056
Sample Description: 123/Window glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A17-A **Lab Sample ID:** 552117361-0057
Sample Description: 205/12" white vinyl floor tile: white with black flecks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/28/2021	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	10/28/2021	Green	0.0%	100.0%	None Detected	

Client Sample ID: A17-B **Lab Sample ID:** 552117361-0058
Sample Description: 205/12" white vinyl floor tile: white with black flecks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray/Black	0.0%	100.0%	None Detected	

Client Sample ID: A17-C **Lab Sample ID:** 552117361-0059
Sample Description: 205/12" white vinyl floor tile: white with black flecks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Green	0.0%	100.0%	None Detected	

Client Sample ID: A18-A **Lab Sample ID:** 552117361-0060
Sample Description: 205/12" white vinyl floor tile mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A18-B **Lab Sample ID:** 552117361-0061
Sample Description: 205/12" white vinyl floor tile mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A18-C **Lab Sample ID:** 552117361-0062
Sample Description: 205/12" white vinyl floor tile mastic

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A19-A **Lab Sample ID:** 552117361-0063
Sample Description: Exterior/Parging cement

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray	<1%	100.0%	None Detected	



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EMSL Canada Order 552117361
Customer ID: 55DCSL97
Customer PO: 30094312
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A19-B

Lab Sample ID: 552117361-0064

Sample Description: Exterior/Parging cement

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/28/2021	Gray	<1%	100.0%	None Detected	

Client Sample ID: A19-C

Lab Sample ID: 552117361-0065

Sample Description: Exterior/Parging cement

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/29/2021	Gray	<1%	100.0%	None Detected	

Analyst(s):

Caroline Allen PLM Grav. Reduction (8)
Ramon Buenaventura PLM (21)
Sandy Burany, Ph.D TEM Grav. Reduction (8)
Steve Grise PLM (35)

Reviewed and approved by:

Matthew Davis or other approved signatory
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. Estimation of uncertainty available upon request. This report is a summary of multiple methods of analysis, fully compliant reports are available upon request. A combination of PLM and TEM analysis may be necessary to ensure consistently reliable detection of asbestos. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government.

Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-139, VT AL998919, ME LB-0039

Initial report from: 10/29/2021 10:16:05



ARCADIS Canada Inc.
ATTN: Dwayne Kellyman
1050 Morrison Drive
Unit 201
Ottawa ON K2H 8K7

Date Received: 18-OCT-21
Report Date: 28-OCT-21 19:40 (MT)
Version: FINAL

Client Phone: 613-721-0555

Certificate of Analysis

Lab Work Order #: L2652690
Project P.O. #: NOT SUBMITTED
Job Reference: 30094312
C of C Numbers:
Legal Site Desc: CFB BORDEN BLDG. A-243

Emily Smith
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2652690-1 P1-WHITE PAINT ON BLOCK WALL, ROOM 109 Sampled By: V. DARUWALA on 12-OCT-21 Matrix: PRODUCT								
Physical Tests								
% Moisture		<0.25		0.25	%	21-OCT-21	22-OCT-21	R5626202
Metals								
Arsenic (As)		<1.0		1.0	ug/g	20-OCT-21	21-OCT-21	R5626301
Chromium (Cr)		14.3		0.50	ug/g	20-OCT-21	21-OCT-21	R5626301
Lead (Pb)		4.7		1.0	ug/g	20-OCT-21	21-OCT-21	R5626301
Mercury (Hg)		0.071		0.050	mg/kg	20-OCT-21	21-OCT-21	R5625986
Polychlorinated Biphenyls								
Aroclor 1016		<0.040	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1221		<0.040	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1232		<0.040	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1242		<0.040	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1248		<0.040	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1254		0.080	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1260		0.057	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1262		<0.040	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Aroclor 1268		<0.040	DLIS	0.040	mg/kg	26-OCT-21	26-OCT-21	R5629084
Total PCBs		0.14	DLIS	0.12	mg/kg	26-OCT-21	26-OCT-21	R5629084
Surrogate: d14-Terphenyl		97.5		50-140	%	26-OCT-21	26-OCT-21	R5629084
L2652690-2 P2-WHITE PAINT ON DRYWALL, ROOM 114 Sampled By: V. DARUWALA on 12-OCT-21 Matrix: PRODUCT								
Physical Tests								
% Moisture		<0.25		0.25	%	21-OCT-21	22-OCT-21	R5626202
Metals								
Arsenic (As)		<1.0		1.0	ug/g	20-OCT-21	21-OCT-21	R5626301
Chromium (Cr)		19.9		0.50	ug/g	20-OCT-21	21-OCT-21	R5626301
Lead (Pb)		7.6		1.0	ug/g	20-OCT-21	21-OCT-21	R5626301
Mercury (Hg)		<0.050		0.050	mg/kg	20-OCT-21	21-OCT-21	R5625986
Polychlorinated Biphenyls								
Aroclor 1016		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1221		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1232		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1242		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1248		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1254		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1260		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1262		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1268		<0.85	DLR	0.85	mg/kg	27-OCT-21	27-OCT-21	R5629084
Total PCBs		<2.6	DLR	2.6	mg/kg	27-OCT-21	27-OCT-21	R5629084
Surrogate: d14-Terphenyl		99.8		50-140	%	27-OCT-21	27-OCT-21	R5629084
L2652690-3 P3-LIGHT BLUE PAINT ON EXTERIOR DOOR, EXTERIOR Sampled By: V. DARUWALA on 12-OCT-21 Matrix: PRODUCT								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2652690-3	P3-LIGHT BLUE PAINT ON EXTERIOR DOOR, EXTERIOR							
Sampled By:	V. DARUWALA on 12-OCT-21							
Matrix:	PRODUCT							
Physical Tests								
% Moisture		<0.25		0.25	%	21-OCT-21	22-OCT-21	R5626202
Metals								
Arsenic (As)		<1.0		1.0	ug/g	20-OCT-21	21-OCT-21	R5626301
Chromium (Cr)		12.3		0.50	ug/g	20-OCT-21	21-OCT-21	R5626301
Lead (Pb)		16.7		1.0	ug/g	20-OCT-21	21-OCT-21	R5626301
Mercury (Hg)		0.155		0.050	mg/kg	20-OCT-21	21-OCT-21	R5625986
Polychlorinated Biphenyls								
Aroclor 1016		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1221		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1232		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1242		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1248		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1254		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1260		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1262		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Aroclor 1268		<1.0	DLR	1.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Total PCBs		<3.0	DLR	3.0	mg/kg	27-OCT-21	27-OCT-21	R5629084
Surrogate: d14-Terphenyl		101.5		50-140	%	27-OCT-21	27-OCT-21	R5629084

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aroclor 1254	DUP-H	L2652690-1, -2, -3
Duplicate	Aroclor 1260	DUP-H	L2652690-1, -2, -3
Matrix Spike	Aroclor 1242	MS-B	L2652690-1, -2, -3
Matrix Spike	Aroclor 1254	MS-B	L2652690-1, -2, -3
Matrix Spike	Aroclor 1260	MS-B	L2652690-1, -2, -3

Sample Parameter Qualifier key listed:

Qualifier	Description
DLIS	Detection Limit Adjusted: Insufficient Sample
DLR	Detection Limit Raised due to required dilution, limited sample amount, and/or high moisture content (soil samples)
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HG-PAINT-WT	Misc.	Mercury by CVAA in Paint Chips	SW846 7470A
MET-200.2-CCMS-WT	Misc.	Metals in Paint and Miscellaneous	EPA 200.2/EPA6020A(mod)
Paint samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.			
MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PCB9-WT	Soil	PCBs	EPA 8270
A representative sub-sample of a soil sample is mixed with methanol and extracted with toluene using a shaker technique. An aliquot of the separated toluene is analyzed by GC/MSD.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg ww_t - milligrams per kilogram based on wet weight of sample

mg/kg lw_t - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2652690

Report Date: 28-OCT-21

Page 1 of 3

Client: ARCADIS Canada Inc.
1050 Morrison Drive Unit 201
Ottawa ON K2H 8K7

Contact: Dwayne Kellyman

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-PAINT-WT	Misc.							
Batch	R5625986							
WG3642187-6	DUP	WG3642187-5						
Mercury (Hg)		<0.050	<0.050	RPD-NA	mg/kg	N/A	40	21-OCT-21
WG3642187-3	LCS							
Mercury (Hg)			103.0		%		70-130	21-OCT-21
WG3642187-1	MB							
Mercury (Hg)			<0.050		mg/kg		0.05	21-OCT-21
MET-200.2-CCMS-WT	Misc.							
Batch	R5626301							
WG3642187-2	CRM	WT-SS-2						
Arsenic (As)			112.9		%		70-130	21-OCT-21
Chromium (Cr)			108.1		%		70-130	21-OCT-21
Lead (Pb)			104.8		%		70-130	21-OCT-21
WG3642187-6	DUP	WG3642187-5						
Arsenic (As)		<1.0	<1.0	RPD-NA	ug/g	N/A	30	21-OCT-21
Chromium (Cr)		19.9	19.1		ug/g	4.3	30	21-OCT-21
Lead (Pb)		7.6	7.1		ug/g	7.2	40	21-OCT-21
WG3642187-4	LCS							
Arsenic (As)			102.1		%		70-130	21-OCT-21
Chromium (Cr)			99.1		%		70-130	21-OCT-21
Lead (Pb)			96.9		%		70-130	21-OCT-21
WG3642187-1	MB							
Arsenic (As)			<1.0		mg/kg		1	21-OCT-21
Chromium (Cr)			<0.50		mg/kg		0.5	21-OCT-21
Lead (Pb)			<1.0		mg/kg		1	21-OCT-21
MOISTURE-WT	Soil							
Batch	R5626202							
WG3642224-3	DUP	L2651739-1						
% Moisture		7.03	7.40		%	5.2	20	22-OCT-21
WG3642224-2	LCS							
% Moisture			98.7		%		90-110	22-OCT-21
WG3642224-1	MB							
% Moisture			<0.25		%		0.25	22-OCT-21
PCB9-WT	Soil							

Quality Control Report

Workorder: L2652690

Report Date: 28-OCT-21

Page 2 of 3

Client: ARCADIS Canada Inc.
1050 Morrison Drive Unit 201
Ottawa ON K2H 8K7

Contact: Dwayne Kellyman

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PCB9-WT		Soil						
Batch	R5629084							
WG3644514-4	DUP	WG3644514-1						
Aroclor 1016		<15	<18	RPD-NA	mg/kg	N/A	50	26-OCT-21
Aroclor 1221		<15	<18	RPD-NA	mg/kg	N/A	50	26-OCT-21
Aroclor 1232		<15	<18	RPD-NA	mg/kg	N/A	50	26-OCT-21
Aroclor 1242		<15	<18	RPD-NA	mg/kg	N/A	40	26-OCT-21
Aroclor 1248		<15	<18	RPD-NA	mg/kg	N/A	40	26-OCT-21
Aroclor 1254		2460	1520	DUP-H	mg/kg	47	40	26-OCT-21
Aroclor 1260		<252	154	DUP-H	mg/kg	48	40	26-OCT-21
Aroclor 1262		<252	<18	RPD-NA	mg/kg	N/A	50	26-OCT-21
Aroclor 1268		<252	<18	RPD-NA	mg/kg	N/A	50	26-OCT-21
WG3644514-3	LCS							
Aroclor 1242			103.6		%		60-140	26-OCT-21
Aroclor 1248			88.1		%		60-140	26-OCT-21
Aroclor 1254			98.3		%		60-140	26-OCT-21
Aroclor 1260			117.8		%		60-140	26-OCT-21
WG3644514-2	MB							
Aroclor 1016			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1221			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1232			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1242			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1248			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1254			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1260			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1262			<0.010		mg/kg		0.01	26-OCT-21
Aroclor 1268			<0.010		mg/kg		0.01	26-OCT-21
Surrogate: d14-Terphenyl			99.4		%		50-140	26-OCT-21
WG3644514-5	MS	WG3644514-1						
Aroclor 1242			N/A	MS-B	%		-	26-OCT-21
Aroclor 1254			N/A	MS-B	%		-	26-OCT-21
Aroclor 1260			N/A	MS-B	%		-	26-OCT-21

Quality Control Report

Workorder: L2652690

Report Date: 28-OCT-21

Client: ARCADIS Canada Inc.
1050 Morrison Drive Unit 201
Ottawa ON K2H 8K7

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Contact: Dwayne Kellyman

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
NSS	Non-standard sample matrix. Modified methods were used for sample processing and analysis.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytic Request Form



COC Number: 17 -

Page of

Canada Toll Free: 1 800 668 9878

L2652690-COFC

www.alsglobal.com

[illegible]

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX C

Summary of Results of Analyses of Bulk Samples for Asbestos Content – Building A-243

Table C.1 Summary of Results of Analyses of Bulk Samples for Asbestos Content – Building A - 243

Sample No.	Sample Location	Sample Description	Asbestos Content
A1-A	Room 105	2'x4' ceiling tile – pinhole and medium fissures	None Detected
A1-B (Photo 4)	Room 103	2'x4' ceiling tile – pinhole and medium fissures	None Detected
A1-C	Room 102	2'x4' ceiling tile – pinhole and medium fissures	None Detected
A2-A	Room 102	Vinyl baseboard – turquoise	None Detected None Detected (TEM)
A2-B (Photo 6)	Room 103	Vinyl baseboard – turquoise	None Detected
A2-C	Room 105	Vinyl baseboard – turquoise	None Detected
A3-A (Photo 5)	Room 102	Turquoise vinyl baseboard mastic	None Detected
A3-B	Room 103	Turquoise vinyl baseboard mastic	None Detected
A3-C	Room 105	Turquoise vinyl baseboard mastic	None Detected
A4-A (Photo 10)	Corridor 1	Stone mortar	None Detected
A4-B	Corridor 2	Stone mortar	None Detected
A4-C	Corridor 2	Stone mortar	None Detected
A5-A (Photo 8)	Corridor 1	Vinyl baseboard – beige	None Detected None Detected (TEM)
A5-B	Corridor 2	Vinyl baseboard – beige	None Detected
A5-C	Corridor 1	Vinyl baseboard – beige	None Detected
A6-A (Photo 9)	Corridor 1	Beige vinyl baseboard mastic	None Detected
A6-B	Corridor 2	Beige vinyl baseboard mastic	Insufficient material (sample bag is empty)
A6-C	Corridor 1	Beige vinyl baseboard mastic	None Detected
A7-A (Photo 7)	Room 105	Drywall joint compound	None Detected
A7-B	Room 114	Drywall joint compound	None Detected
A7-C	Room 123	Drywall joint compound	None Detected
A7-D	Corridor 3	Drywall joint compound	None Detected
A7-E	Room 103	Drywall joint compound	None Detected

FINAL REPORT – DESIGNATED SUBSTANCES SURVEY – BUILDING A-243

Sample No.	Sample Location	Sample Description	Asbestos Content
A7-F	Room 205	Drywall joint compound	None Detected
A7-G	Room 205	Drywall joint compound	None Detected
A8-A (Photo 11)	Room 105	Vinyl sheet flooring – turquoise	None Detected None Detected (TEM)
A8-B	Corridor 1	Vinyl sheet flooring – turquoise	None Detected
A8-C	Corridor 2	Vinyl sheet flooring – turquoise	None Detected
A9-A	Corridor 1	Vinyl sheet flooring – beige	None Detected None Detected (TEM)
A9-B (Photo 12)	Corridor 2	Vinyl sheet flooring – beige	None Detected
A9-C	Corridor 3	Vinyl sheet flooring – beige	None Detected
A10-A	Room 114	Block filler paint	None Detected
A10-B	Room 125	Block filler paint	None Detected
A10-C (Photo 13)	Room 116	Block filler paint	None Detected
A10-D	Room 109	Block filler paint	None Detected
A10-E	Stairwell 1	Block filler paint	None Detected
A10-F	Boiler Room	Block filler paint	None Detected
A10-G	Electrical Room	Block filler paint	None Detected
A11-A	Room 109	Concrete block mortar	None Detected
A11-B (Photo 15)	Room 110	Concrete block mortar	None Detected
A11-C	Stairwell 1	Concrete block mortar	None Detected
A12-A	Corridor 1	Door frame caulking – white	None Detected None Detected (TEM)
A12-B (Photo 16)	Corridor 2	Door frame caulking – white	None Detected
A12-C	Room 114	Door frame caulking – white	None Detected
A13-A (Photo 18)	Room 123	Vinyl sheet flooring – black	None Detected

FINAL REPORT – DESIGNATED SUBSTANCES SURVEY – BUILDING A-243

Sample No.	Sample Location	Sample Description	Asbestos Content
			None Detected (TEM)
A13-B	Room 124	Vinyl sheet flooring – black	None Detected
A13-C	Room 123	Vinyl sheet flooring – black	None Detected
A14-A (Photo 17)	Room 123	Black vinyl sheet flooring mastic	None Detected
A14-B	Room 123	Black vinyl sheet flooring mastic	None Detected
A14-C	Room 123	Black vinyl sheet flooring mastic	None Detected
A15-A (Photo 19)	Room 123	2'x4' ceiling tile – pinholes and long fissures	None Detected
A15-B	Room 123	2'x4' ceiling tile – pinholes and long fissures	None Detected
A15-C	Room 123	2'x4' ceiling tile – pinholes and long fissures	None Detected
A16-A	Room 123	Window glazing	None Detected None Detected (TEM)
A16-B	Room 123	Window glazing	None Detected
A16-C (Photo 20)	Room 123	Window glazing	None Detected
A17-A (Photo 23)	Room 205	12" white vinyl floor tile – white with black flecks	None Detected None Detected (TEM)
A17-B	Room 205	12" white vinyl floor tile – white with black flecks	None Detected
A17-C	Room 205	12" white vinyl floor tile – white with black flecks	None Detected
A18-A (Photo 24)	Room 205	12" white vinyl floor tile (white with black flecks) – mastic	None Detected
A18-B	Room 205	12" white vinyl floor tile (white with black flecks) – mastic	None Detected
A18-C	Room 205	12" white vinyl floor tile (white with black flecks) – mastic	None Detected
A19-A	Exterior	Parging cement	None Detected
A19-B	Exterior	Parging cement	None Detected
A19-C	Exterior	Parging cement	None Detected

NOTE:

Bulk samples were analyzed by Polarized Light Microscopy (PLM) analysis, except where “TEM” is noted, in which case Transmission Electron Microscopy analysis was also performed.

APPENDIX D

Photographs

Project Photographs

BuildingA - 243
CFB Borden, Ontario



Photo: 1

Date:

October 12, 2021.

Location/Description:

General East view of Building A – 243.



Photo: 2

Date:

October 12, 2021.

Location/Description:

General North view of Building A – 243.



Photo: 3

Date:

October 12, 2021.

Location/Description:

General South view of Building A – 243.

Project Photographs

Building A - 243
CFB Borden, Ontario

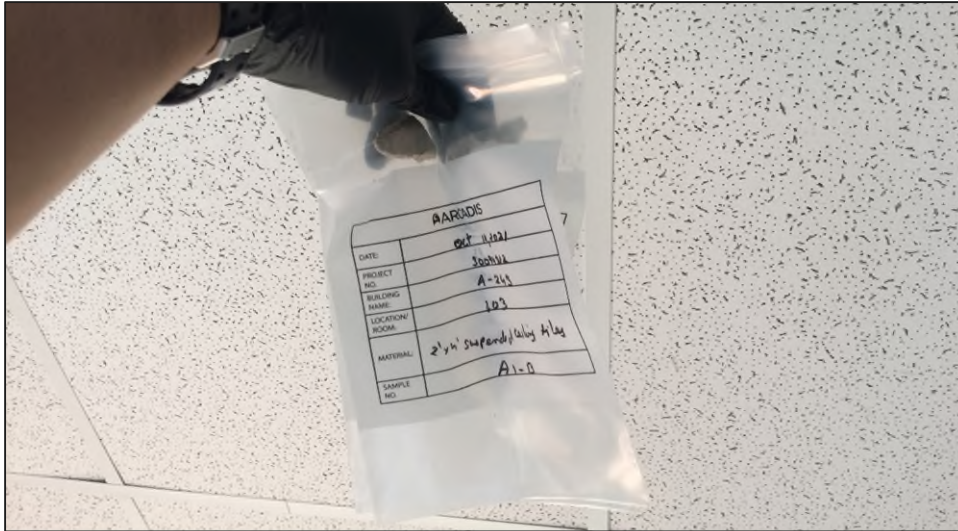


Photo: 4

Date:

October 12, 2021.

Location/Description:

Room 103/Sample A1-B –
Non-asbestos-containing 2'x4'
ceiling tile with pinholes and
fissures.

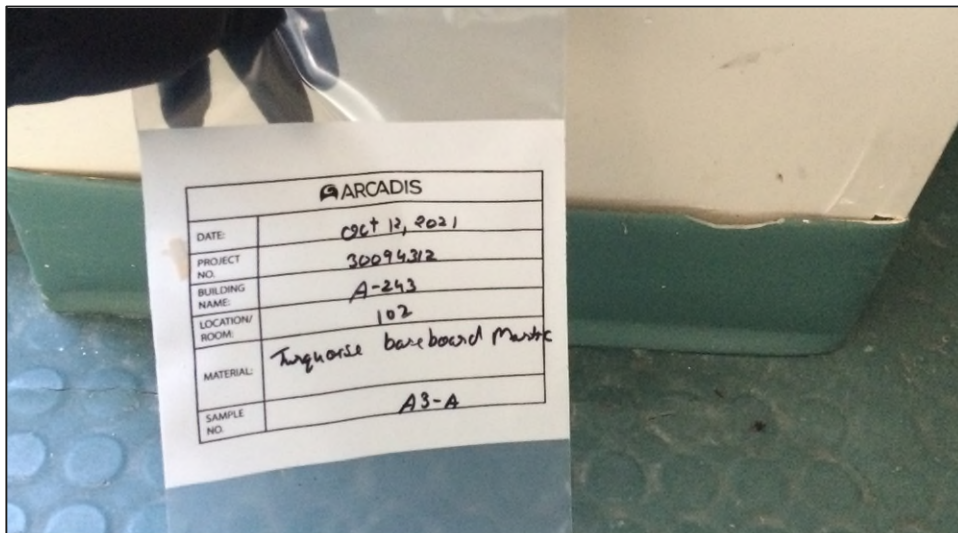


Photo: 5

Date:

October 12, 2021.

Location/Description:

Room 102/Sample A3-A –
Non-asbestos-containing
mastic behind baseboard –
turquoise.

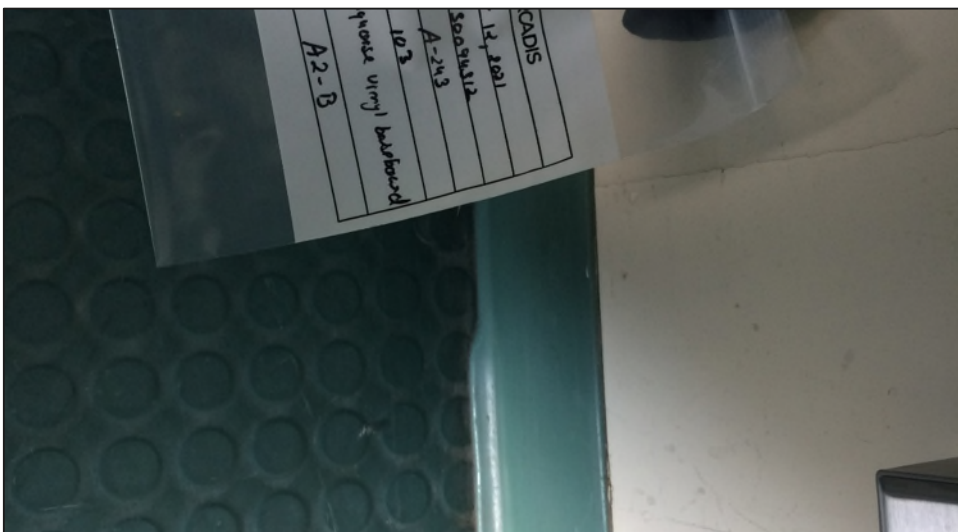


Photo: 6

Date:

October 12, 2021.

Location/Description:

Room B001/Sample A2-B –
Non-asbestos-containing vinyl
baseboard – turquoise.

Project Photographs

Building A - 243
CFB Borden, Ontario

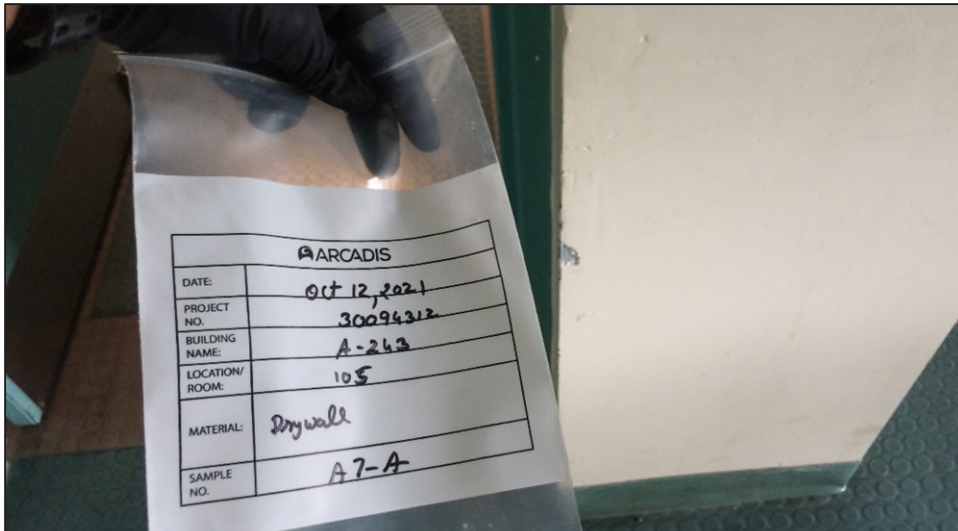


Photo: 7

Date:

October 12, 2021.

Location/Description:

Room 105/Sample A7-A –
Non-asbestos-containing
drywall joint compound.

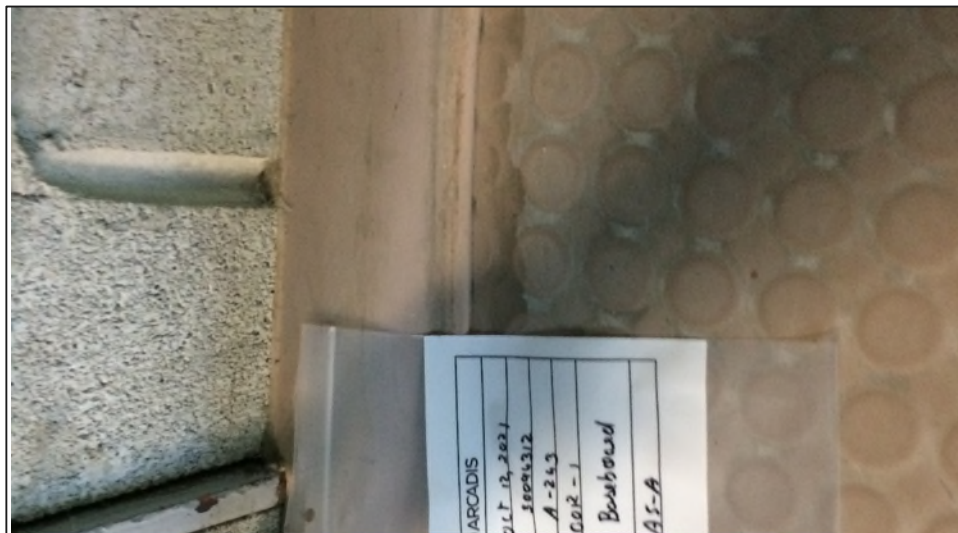


Photo: 8

Date:

October 12, 2021.

Location/Description:

Corridor-1/Sample A5-A –
Non-asbestos-containing
beige vinyl baseboard.

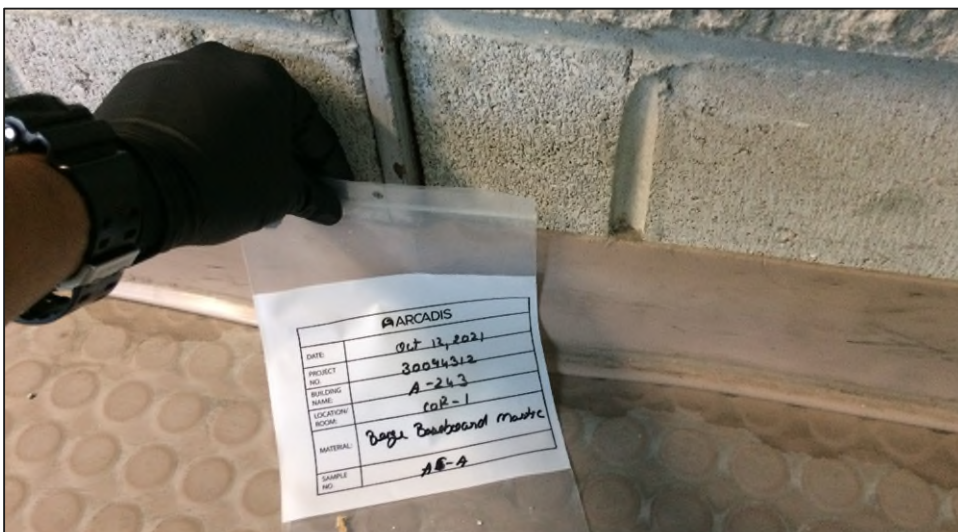


Photo: 9

Date:

October 12, 2021.

Location/Description:

Corridor-1/Sample A6-A –
Non-asbestos-containing
mastic behind beige vinyl
baseboard.

Project Photographs

Building A - 243
CFB Borden, Ontario

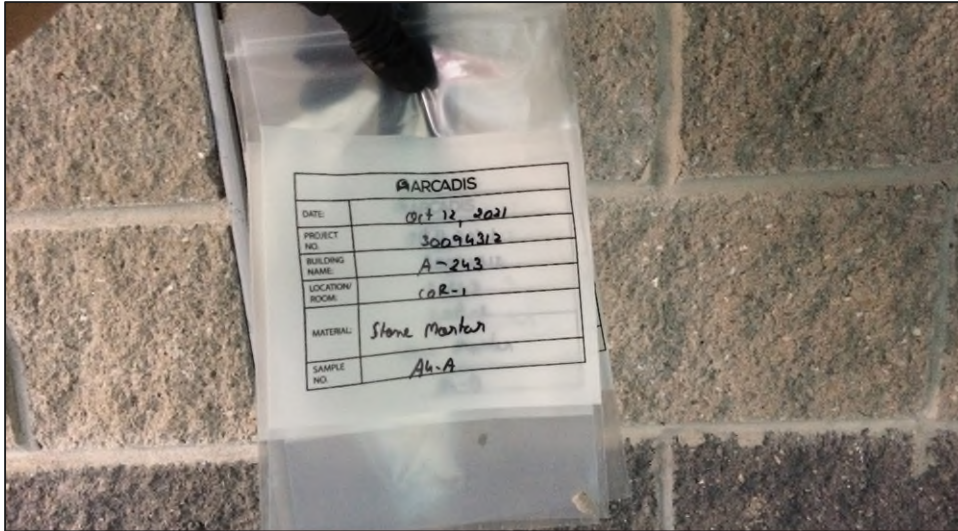


Photo: 10

Date:

October 12, 2021.

Location/Description:

Corridor-1/Sample A4-A –
Non-asbestos-containing
stone mortar.



Photo: 11

Date:

October 12, 2021.

Location/Description:

Room 105/Sample A8-A –
Non-asbestos-containing
turquoise vinyl sheet flooring.



Photo: 12

Date:

October 12, 2021.

Location/Description:

Corridor-2/Sample A9-B –
Non-asbestos-containing
beige vinyl sheet flooring.

Project Photographs

Building A - 243
CFB Borden, Ontario

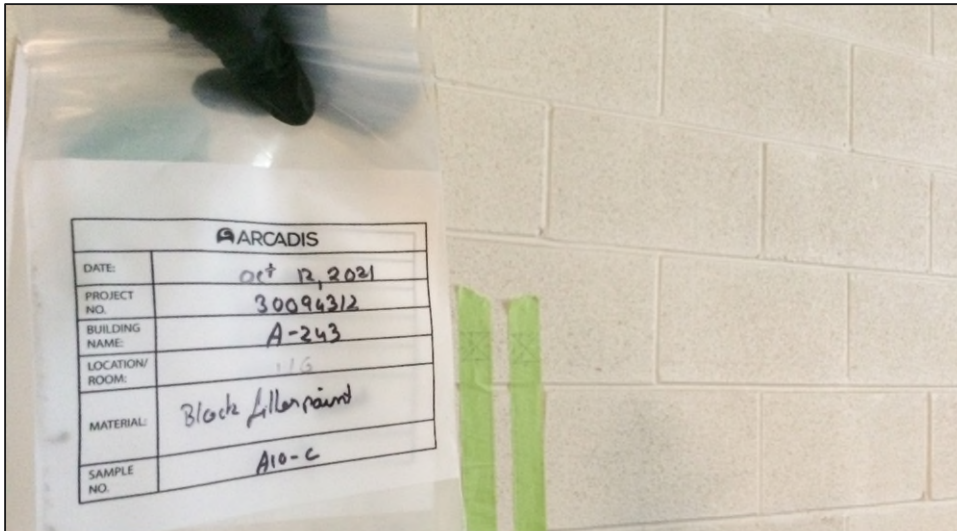


Photo: 13

Date:

October 12, 2021.

Location/Description:

Room 116/Sample A10-C –
Non-asbestos-containing
block filler paint.

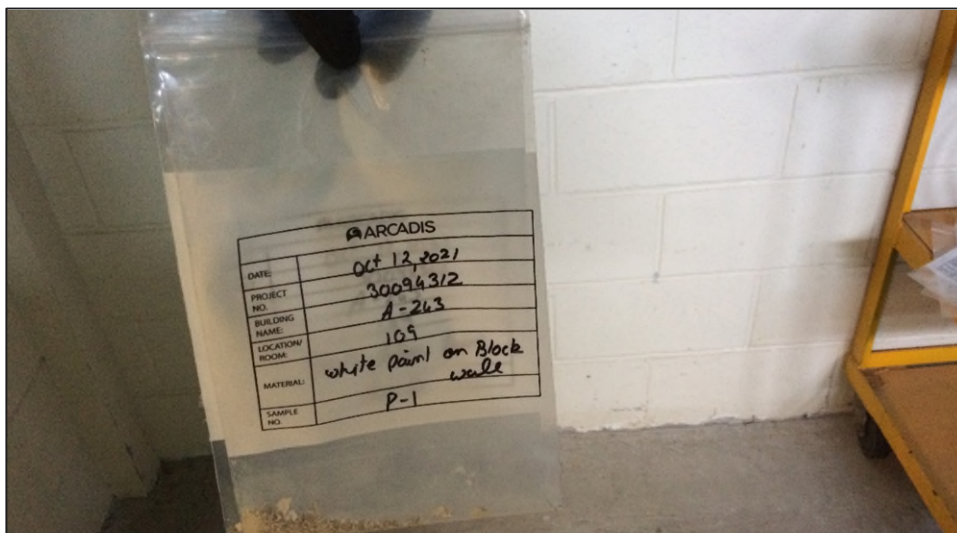


Photo: 14

Date:

October 12, 2021.

Location/Description:

Room 109/Sample P-1 –
White paint on block wall. No
parameters exceeded.

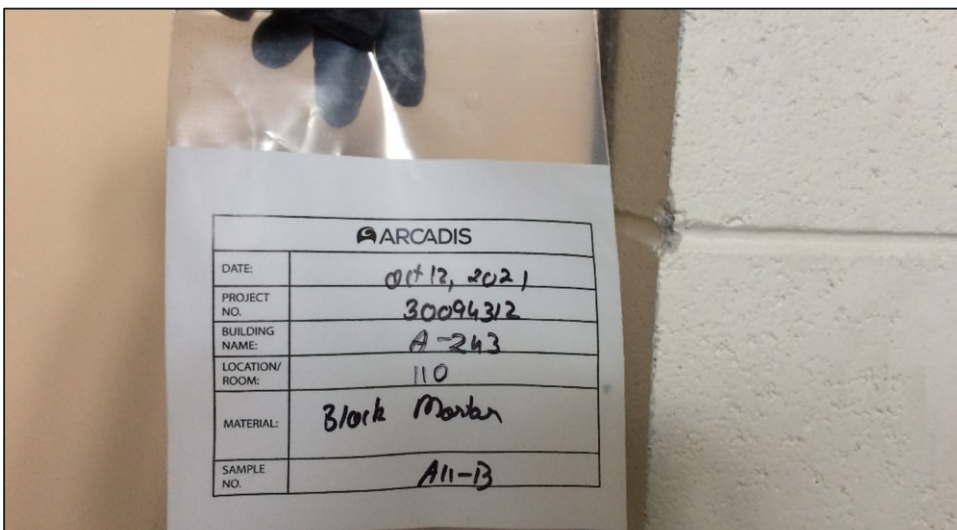


Photo: 15

Date:

October 12, 2021.

Location/Description:

Room 110/Sample A11-B –
Non-asbestos-containing
concrete block mortar.

Project Photographs

Building A - 243
CFB Borden, Ontario

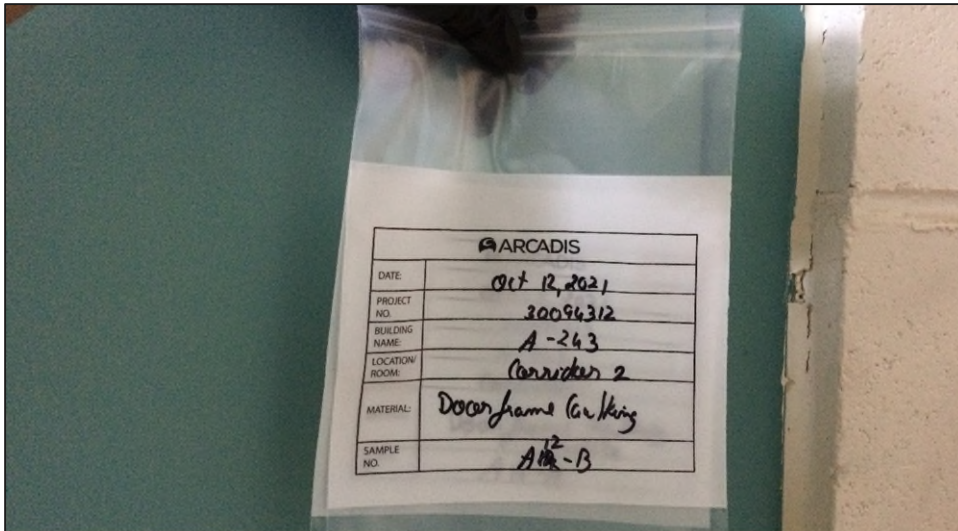


Photo: 16

Date:

October 12, 2021.

Location/Description:

Corridor-2/Sample A12-B –
Non-asbestos-containing
white door frame caulking.



Photo: 17

Date:

October 12, 2021.

Location/Description:

Room 123/Sample A14-A –
Non-asbestos-containing
mastic behind black vinyl
sheet flooring.



Photo: 18

Date:

October 12, 2021.

Location/Description:

Room 123/Sample A13-A –
Non-asbestos-containing
black vinyl sheet flooring.

Project Photographs

Building A - 243
CFB Borden, Ontario

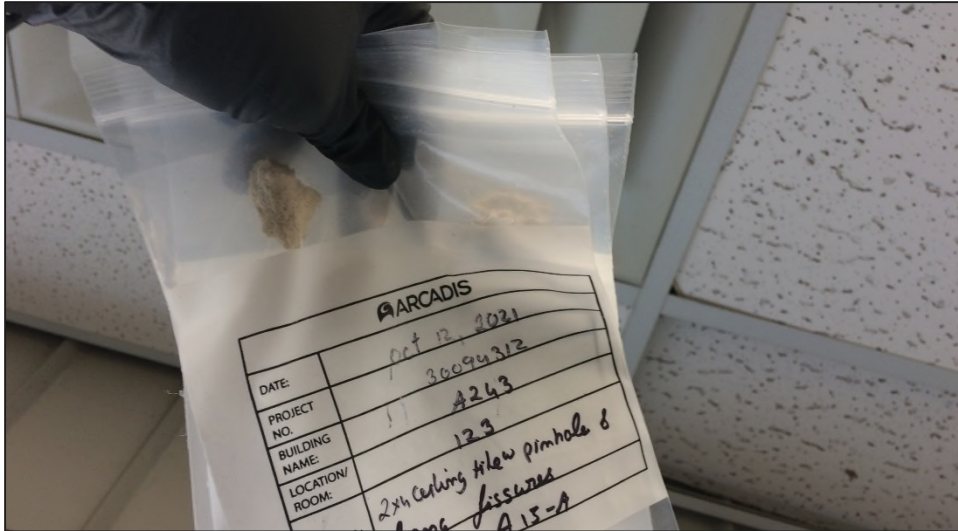


Photo: 19

Date:

October 12, 2021.

Location/Description:

Room 123/Sample A15-A – Non-asbestos-containing 2'x4' ceiling tile with pinholes and long fissures.

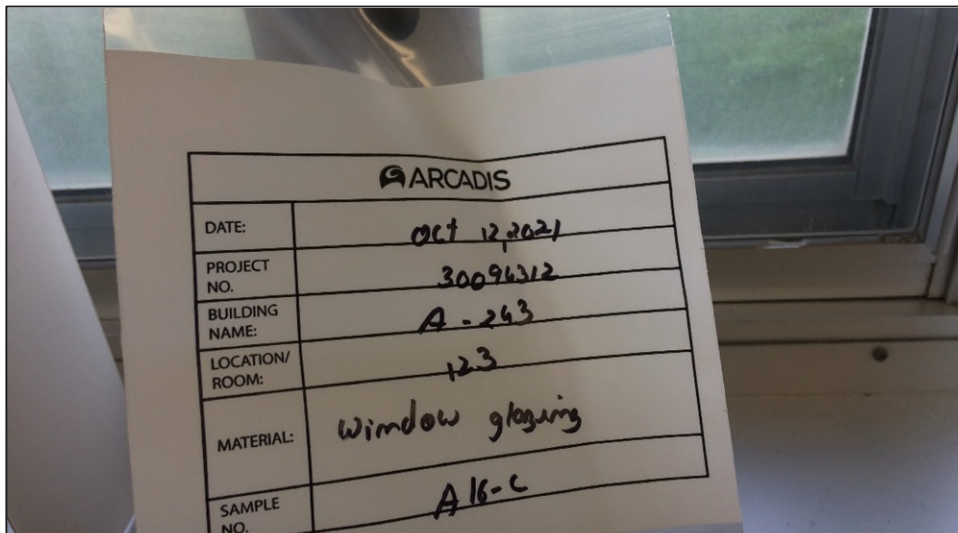


Photo: 20

Date:

October 12, 2021.

Location/Description:

Room 123/Sample A16-C – Non-asbestos-containing window glazing.



Photo: 21

Date:

October 12, 2021.

Location/Description:

View inside the POL shed at Building A-243.

Project Photographs

Building A - 243
CFB Borden, Ontario



Photo: 22

Date:

October 12, 2021.

Location/Description:

Room 205/View of suspect mould growth on non-asbestos ceiling tile.

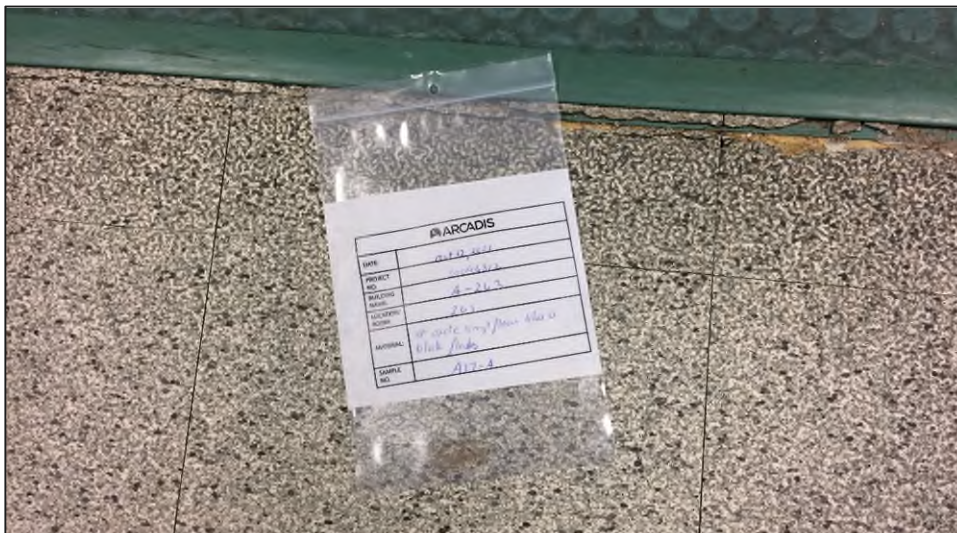


Photo: 23

Date:

October 12, 2021.

Location/Description:

Room 205/Sample A17-A – Non-asbestos containing 12" vinyl floor tile with black flecks.

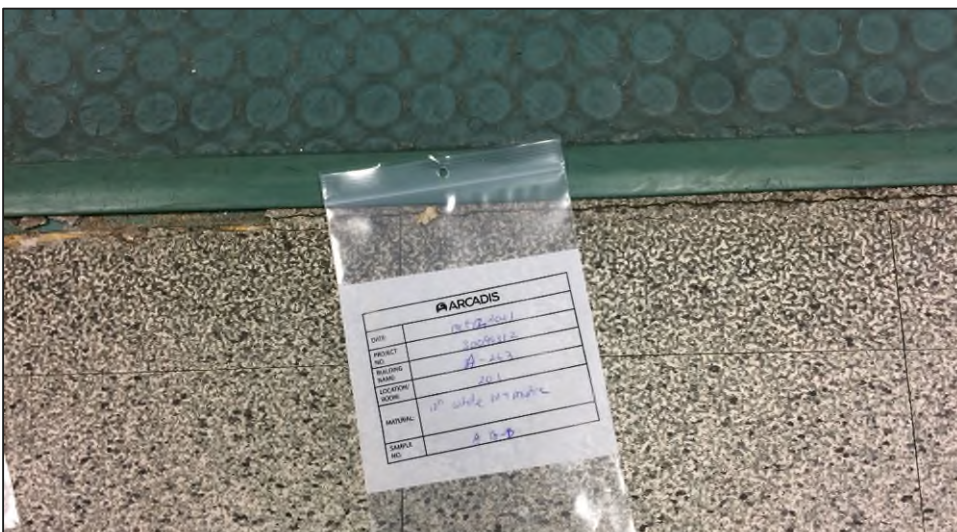


Photo: 24

Date:

October 12, 2021.

Location/Description:

Room 205/Sample A18-B – Non-asbestos containing mastic behind 12" vinyl floor tile with black flecks.

Project Photographs

Building A - 243
CFB Borden, Ontario

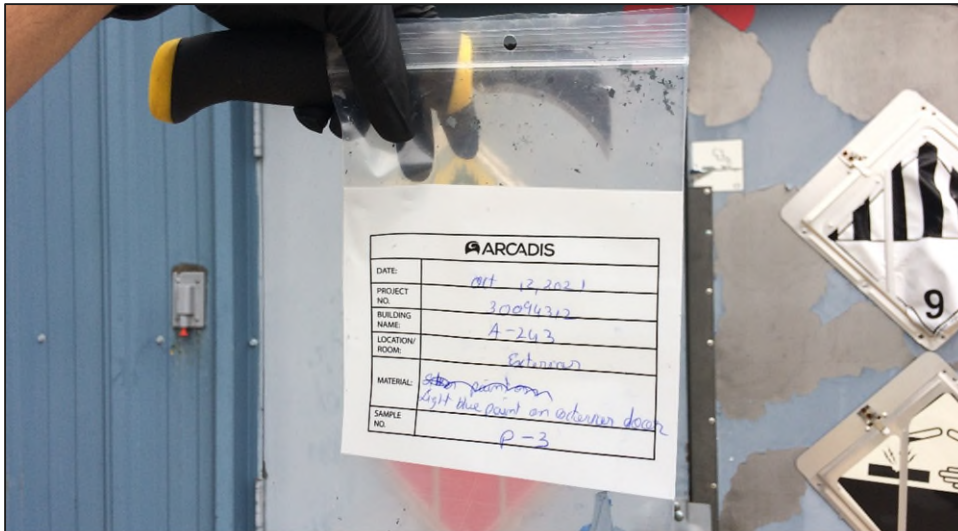


Photo: 25

Date:

October 12, 2021.

Location/Description:

Exterior/Sample P-3 – Light blue paint on exterior door. No parameters exceeded.



Photo: 26

Date:

October 12, 2021.

Location/Description:

Boiler Room/Boiler – May contain asbestos-containing material.

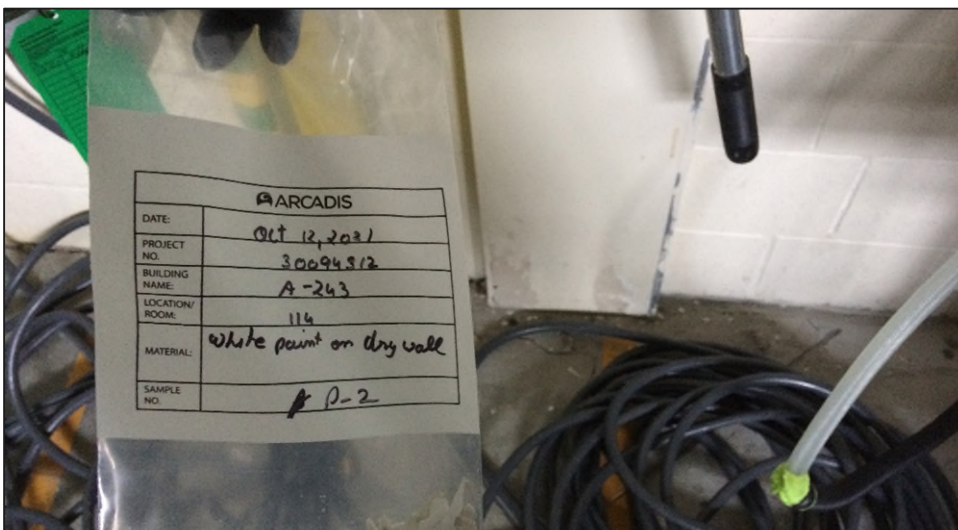


Photo: 27

Date:

October 12, 2021.

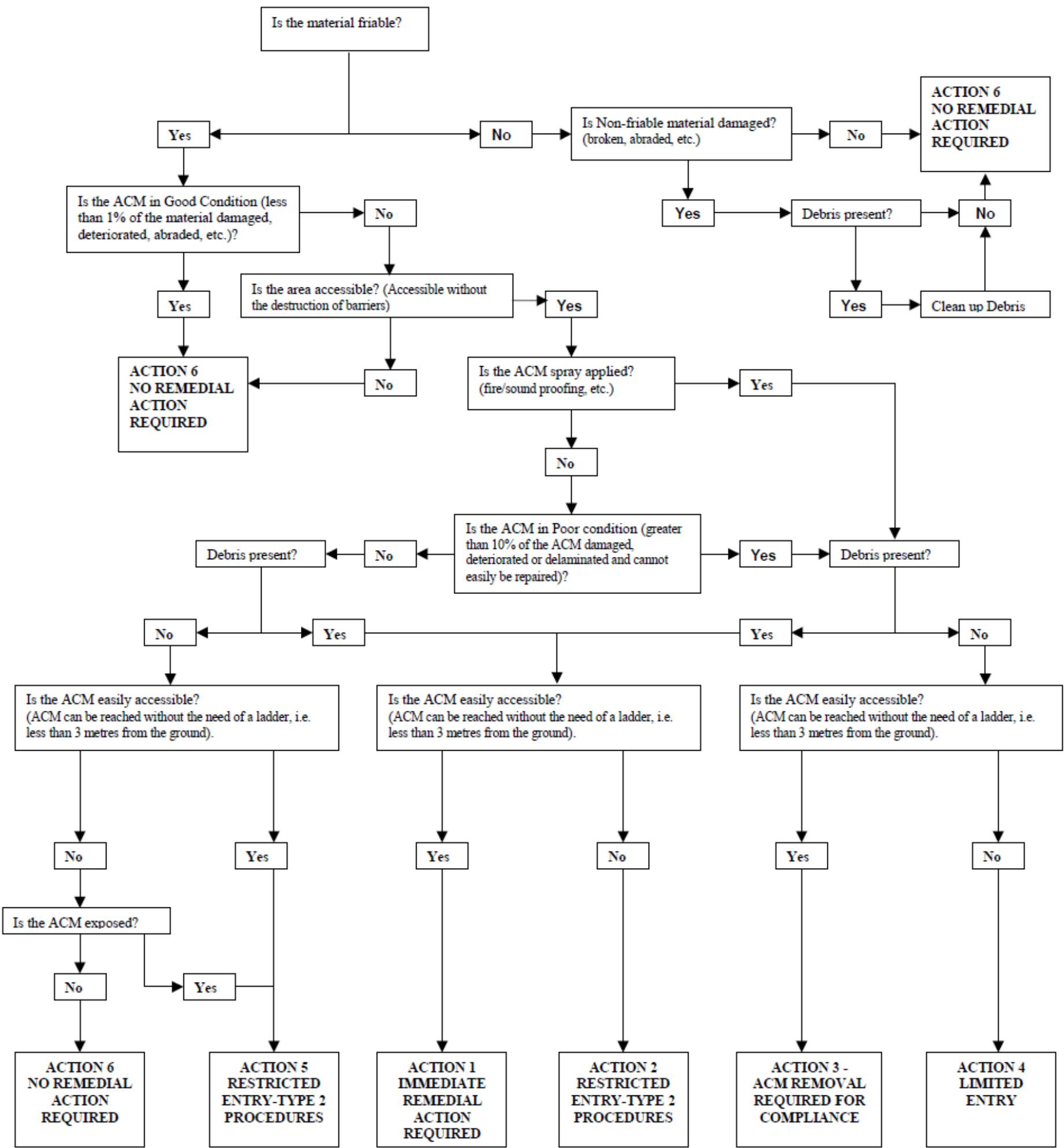
Location/Description:

Room 114 /Sample P-2 – White paint on drywall wall. No parameters exceeded.

APPENDIX E

Asbestos Condition Assessment and Response Chart

ASBESTOS CONDITION ASSESSMENT
AND RESPONSE CHART



ACTION 1 –	Restrict access to the area and clean up the ACM debris using appropriate asbestos procedures.
ACTION 2 –	Restricted Entry into areas that contain, or may contain ACM Debris. All entry into the area will require at a minimum Type 2 procedures until the ACM debris have been cleaned up, and the source of the debris have been stabilized or removed.
ACTION 3 –	Asbestos removal required for compliance. Develop scope of work and utilize appropriate removal procedures.
ACTION 4 –	Limited Entry: personnel who enter into these areas have to be aware of the presence of the type and location of the ACM. If any entry into the area may cause a disturbance of the ACM, Type 2 procedures must be used for entry until the ACM is removed.
ACTION 5 –	ACM may be repaired if the ACM is considered to be in Fair Condition (less than 10% damaged), and it is unlikely for the material to be damaged, or disturbed again. Once the ACM has been repaired it may be treated as in GOOD condition (less than 1% damaged).
ACTION 6 –	No remedial action is required. The materials are to be managed in accordance with the Asbestos Management Directive.
NOTE:	<i>Pro Active Removal may be a part of an Asbestos Management plan or for removal of ACM that are in locations that may not be desirable regardless of the materials condition.</i>

APPENDIX F

MOL – Sample List of Suspect Asbestos-Containing Building Materials

Appendix 2 – Sample List of Suspect Asbestos-Containing Building Materials

Issued: November 2007

Content last reviewed: May 2011

There are an estimated 3000 products that contain asbestos. In Ontario asbestos was widely used in sprayed-on material and in pipe and boiler insulation until 1973^[3]. The use of many other asbestos containing materials continued until the mid 1980's. Asbestos is still used in the manufacture of a limited number of products, including some floor tiles, cement products, friction materials and textiles. The following list was adapted from the United States Environmental Protection Agency's (EPA) Sample List of Suspect Asbestos Containing Materials^[4]. It is not an all inclusive list but is intended as a general guide to show which types of building materials may contain asbestos.

Possible Asbestos-Containing Materials in Buildings

- Acoustical Plaster
- Adhesives
- Asphalt Floor Tile
- Base Flashing
- Blown-in (Loose fill) Insulation
- Boiler Insulation
- Breaching Insulation
- Caulking/Putties
- Ceiling Tiles and Lay-in Panels
- Cement Pipes
- Cement Siding
- Cement Wallboard
- Construction Mastics (floor tile, carpet, ceiling tile, etc.)
- Cooling Towers
- Decorative Plaster
- Ductwork Flexible Fabric Connections
- Electrical Cloth
- Electrical Panel Partitions
- Electrical Wiring Insulation
- Elevator Brake Shoes
- Elevator Equipment Panels
- Fire Doors
- Fireproofing Materials
- Flooring Backing
- Heating and Electrical Ducts
- High Temperature Gaskets
- HVAC Duct Insulation
- Joint Compounds
- Pipe Insulation (corrugated air-cell, block, etc.)
- Roofing Felt
- Roofing Shingles
- Spackling Compounds
- Sprayed-on Insulation

- Taping Compounds (thermal)
- Textured Paints/Coatings
- Thermal Paper Products
- Vinyl Floor Tile
- Vinyl Sheet Flooring
- Vinyl Wall Coverings
- Wallboard

[3] J.S. Dupre, J.F. Mustard & R.J. Uffin, *Report of the Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario*, Ontario Ministry of the Attorney General, Toronto, Ontario, 1984, page 12.

[4] US Environmental Protection Agency.

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Disclaimer: This web resource has been prepared to assist the workplace parties in understanding some of their obligations under the Occupational Health and Safety Act (OHSA) and the regulations. It is not intended to replace the OHSA or the regulations and reference should always be made to the official version of the legislation.

It is the responsibility of the workplace parties to ensure compliance with the legislation. This web resource does not constitute legal advice. If you require assistance with respect to the interpretation of the legislation and its potential application in specific circumstances, please contact your legal counsel.

While this web resource will also be available to Ministry of Labour inspectors, they will apply and enforce the OHSA and its regulations based on the facts as they may find them in the workplace. This web resource does not affect their enforcement discretion in any way.



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EMAIL TRANSMISSION

May 11, 2018

Mr. Boyce Parrill

Department of National Defense, Real Properties Operations Detachment
Canadian Forces Base Borden
P.O. Box 1000 Station Main
16 Ramillies Road
Borden, ON
L0M 1C0

RE: Bulk Asbestos Sampling
Building A-243, Paint Booth
Canadian Forces Base Borden
Borden, ON
Our Ref.: 128-P-0015403-0-10-GA-L-0001-00

Further to your request and in accordance with our Public Works and Government Services Canada (PWGSC) Standing Offer/Contract E6TOR-16RM04/001/KIN, Englobe Corp. (Englobe) has prepared this report to document the work which it has completed with respect to the above noted project.

Englobe Corp. ("Englobe") was retained by PWGSC to collect concrete samples from two trenches within the Paint Booth of Building A-243, 17 Hangar Road. The samples were collected on April 23, 2018 at the direction of Mr. Boyce Parrill, on behalf of Real Properties Operations Detachment, Canadian Forces Base Borden (the "Client").

As requested by the Client, Englobe submitted the samples to EMSL Canada Inc. (EMSL) being a NVLAP accredited laboratory located in Mississauga, Ontario. The bulk samples were submitted for determination of asbestos content by Polarized Light Microscopy (PLM) analysis, in accordance with Ontario Regulation 278/05 (Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations). The results of the analysis are presented below in Table 1, and copies of the Certificate of Analysis are attached in Appendix 1.

Table 1: Bulk Sampling Results

Sample ID	Sample Description	Sample Location	Ontario Regulation 278/05 Criteria (% by dry weight)	Result
1A	Trench 1 (Left side Trench)	Base of stairway	0.5%	None Detected
1B		Stairway		None Detected
1C		Top of Wall near Stairway entrance		None Detected

May 11, 2018

Sample ID	Sample Description	Sample Location	Ontario Regulation 278/05 Criteria (% by dry weight)	Result
2A	Trench 2 (Right side Trench)	Stairway		None Detected
2B		Stairway		None Detected
2C		Wall of Stairway		None Detected

CONCLUSIONS

Based on the above-noted findings, Englobe concludes the following:

- ▶ As documented in Table 1 above and in the EMSL Certificate of Analysis in Appendix 1, the concrete materials collected by Englobe from the trenches in the Paint Booths of Building A-243 and submitted for analysis were reported to not contain asbestos, as defined in Regulation 278/05 of the Ontario Occupational Health and Safety Act (i.e. asbestos was not detected at concentrations equal to or greater than 0.5% by dry weight).

This letter should be read in conjunction with the statement of limitations provided in Appendix 3.

We trust that this summary letter meets with your approval. If you should require any additional information, please do not hesitate to contact us.



Carla Noseworthy, CET
Project Manager



Mahmood Ghinani, P. Eng
Director, Environmental Services, Ontario

Encl.
Appendix 1 – Laboratory Certificate of Analysis – Bulk Asbestos Sampling
Appendix 2 – Photographs
Appendix 3 – Statement of Limitations

Appendix 1 Laboratory Certificate of Analysis



EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 551804693
Customer ID: 55LVMT42
Customer PO: A19949
Project ID:

Attn: CARLA NOSEWORTHY, CET
EnGlobe Corp.
1821 Albion Road, Unit 7
Toronto, ON M9W 5W8

Phone: (416) .21-1060
Fax:
Collected: 4/23/2018
Received: 4/23/2018
Analyzed: 4/30/2018

Proj: P-0015403-0-10-200 (A243) / P.O. # A19949 / Quote 552018329984

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 15403-10-1A **Lab Sample ID:** 551804693-0001

Sample Description: Concrete, Trench, LHS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	4/30/2018	Gray	0%	100%	None Detected	

Client Sample ID: 15403-10-1B

Lab Sample ID: 551804693-0002

Sample Description: Concrete, Trench, LHS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	4/30/2018	Gray	0%	100%	None Detected	

Client Sample ID: 15403-10-1C

Lab Sample ID: 551804693-0003

Sample Description: Concrete, Trench, LHS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	4/30/2018	Gray	0%	100%	None Detected	

Client Sample ID: 15403-10-2A

Lab Sample ID: 551804693-0004

Sample Description: Concrete, Trench, RHS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	4/30/2018	Gray	0%	100%	None Detected	

Client Sample ID: 15403-10-2B

Lab Sample ID: 551804693-0005

Sample Description: Concrete, Trench, RHS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	4/30/2018	Gray	0%	100%	None Detected	

Client Sample ID: 15403-10-2C

Lab Sample ID: 551804693-0006

Sample Description: Concrete, Trench, RHS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	4/30/2018	Gray	0%	100%	None Detected	



EMSL Canada Inc.

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Phone/Fax: (289) 997-4602 / (289) 997-4607
<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 551804693
Customer ID: 55LVMT42
Customer PO: A19949
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Michelle Lung PLM (4)
Natalie D'Amico PLM (2)

Reviewed and approved by:

Matthew Davis or other approved signatory
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 04/30/2018 14:42:30

Appendix 2 Photographs



Photograph 01: Trench 1, left sided trench (from overhead doors)



Photograph 02: Trench 2, right side trench (from overhead doors)

Appendix 3

Statement of
Limitations

STATEMENT OF LIMITATIONS

This report was prepared for the exclusive use of Public Works and Government Services Canada and is based on data and information obtained during a site visit by Englobe on the subject property; and is based solely upon the condition of the property on the date of such inspection, supplemented by information obtained and described herein.

No section of this report can be used as a whole entity. The report must be considered in its entirety. Englobe will not accept any responsibility resulting directly or indirectly from the use of this report by any person or entity other than that to which it is subjected.

The present report represents Englobe's assessment of the conditions prevailing on the Site during the period of time covered by the mandate, or the points in time indicated in this report. The assessment of conditions also depended on the information made available in this period of time. The information presented in our report only applies to the subject site described in this report. All information contained in this report is based essentially on visual observations of the subject site, as well as analytical results for selected parameters and materials, and this within a specific period of time, all of which have been defined in the present report. Unless otherwise specified, the conclusions of this report are not valid for prior or future conditions of the subject site, or for portions of the subject site not made available for direct investigations. If a substance has not been analyzed, this does not exclude the possibility of its presence on the site in concentrations exceeding the background value, the analytical detection limit or the threshold dictated by a by law, policy or ruling.

In the case where changes occur to the conditions prevailing on the Site, or to the set of applicable policies, regulation or criteria, or in the case where additional information was made available following the submittal of this report, the content of the latter may be revised, in the scope of an additional mandate.

When no policy, regulation or criteria was available for the interpretation of data, the comments, recommendations and conclusions expressed in this report were based on the generally recognized rules and practices. The use of this report, as well as of its content by a third party is strictly prohibited without having obtained Englobe's and its client's prior written authorization to do so. Third parties using this report or its content take full responsibility of doing so. Englobe provides no guarantee and disclaims any obligation towards third parties and disclaims any liability whatever it may consist of towards all losses, expenses, damages, fines, penalties and other harm that any other person may suffer by the use of this report and of its content. It is important to note that the opinions expressed in our report are solely technical. These opinions cannot and should not be considered as a legal advice.