



National Defence

**Canadian Forces
Housing Agency**

Défense nationale

**Agence de logement
des Forces canadiennes**

Canadian Forces Housing Agency

(CFHA) Apartment Buildings

Tier 4 6-Plex

Canadian Forces Base (CFB) Kingston

Kingston, ON

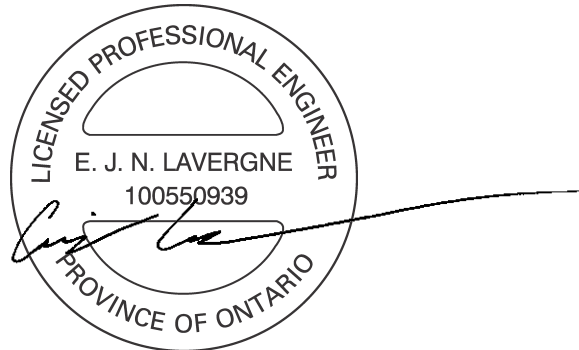
PF ZKN99

Specifications, Issued for Tender

24 January 2025

Canada 





January 24, 2025



The above Engineering Seal applies to the following Sections:

Division 21 - FIRE SUPPRESSION

Section 21 05 01 - Common Work Results for Mechanical
Section 21 13 13 - Wet Pipe Sprinkler Systems
Section 21 25 00 - Portable Fire Extinguishers

Division 22 - PLUMBING

Section 22 05 15 - Plumbing Specialties and Accessories
Section 22 11 16 - Domestic Water Piping
Section 22 13 16 - Drainage and Vent Piping
Section 22 33 00 - Domestic Water Heaters
Section 22 42 13 - Commercial Plumbing Fixtures

Division 23 - HEATING, VENTILATION, AND AIR-CONDITIONING (HVAC)

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Section 23 05 15 - Common Installation Requirements for Pipework
Section 23 05 23.01 - Valves - Bronze
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 05 53 - Identification for HVAC Piping and Equipment
Section 23 05 93 - Testing, Adjusting & Balancing for HVAC
Section 23 07 13 - Duct Insulation
Section 23 07 19 - Thermal Insulation for Piping
Section 23 09 33 - Electric and Electronic Control System for HVAC
Section 23 33 00 - Air Duct Accessories
Section 23 33 14 - Dampers - Balancing
Section 23 33 15 - Dampers - Operating
Section 23 33 16 - Dampers - Fire and Smoke
Section 23 33 46 - Flexible Ducts
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Section 23 37 13 - Diffusers, Registers and Grilles
Section 23 37 20 - Louvres, Intakes and Vents
Section 23 72 00 - Air to Air Energy Recovery Equipment
Section 23 81 26 - Split System Air Conditioners & Heat Pumps
Section 23 82 16.14 - Electric-Resistance Air Coils
Section 23 82 25 - Cabinet Heaters





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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises construction of two new apartment buildings (6-units each) at Canadian Forces Base Kingston, Ontario.

1.2 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for Work, storage, and access, to allow:
 - .1 Work by other contractors.
- .2 Co-ordinate use of premises under advisement of DCC Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.3 ADJACENT OCCUPANCY

- .1 Tenants will occupy adjacent premises during entire construction period for execution of normal operations. Co-operate with DCC Representative in scheduling operations to minimize conflict and to accommodate adjacent tenants with minimal disturbances.

1.4 EXISTING SERVICES

- .1 Establish location and extent of service lines in area of work before starting Work. Notify DCC Representative of findings.
- .2 Notify DCC Representative and DND utility companies of intended interruption of services and obtain required permission.
- .3 Where Work involves breaking into or connecting to existing services, give DCC Representative 14 days' notice for approval of necessary interruption of mechanical or electrical service or road closure throughout course of work. Minimize duration of interruptions. Carry out interruptions to mechanical and electrical services Monday to Friday, 7:30am to 3:30pm.
- .4 Provide alternative routes for personnel pedestrian and vehicular traffic.
 - .1 Refer to Section 01 55 26 - Traffic Control.
- .5 Establish location and extent of service lines in area of work before starting Work. Notify DCC Representative of findings.
- .6 Submit schedule to and obtain approval from DCC Representative for shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

- .7 Where unknown services are encountered, immediately advise DCC Representative and confirm findings in writing.
- .8 Protect, relocate, or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed and abandoned service lines.
- .10 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 EXCAVATION PERMITS

- .1 Prior to commencing excavation, obtain utility locate request indicating known buried utilities. Submit copy of locate request report to DCC Representative.

1.6 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy of each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

END OF SECTION

Part 1 General

1.1 STANDARD HOURS

- .1 Contractor normal work hours:
 - .1 0700 hrs to 1800 hrs Monday to Friday
 - .2 When work is required outside of the above noted hours, the Contractor will make a written request for permission to the DCC Representative at least 72 hours in advance.

1.2 ACCESS AND EGRESS

- .1 Design, construct, and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps, ladders, and scaffolding, independent of finished Work and in accordance with relevant municipal, provincial, and other regulations.

1.3 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to building occupants, public, and normal use of premises. Arrange with DCC Representative to facilitate execution of work.
- .2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic, and security regulations.
- .3 Maintain existing services to site and provide for personnel and vehicle access.
- .4 Keep within limits of work and avenues of ingress and egress.
- .5 Closures: Protect work temporarily until permanent enclosures are completed.

1.4 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.
- .3 Prevent overloading of parts of building.

1.5 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.

1.6 BUILDING SMOKING ENVIRONMENT

- .1 Smoking is prohibited inside buildings.

- .2 Comply with Base smoking policy.

END OF SECTION

1 GENERAL

1.0 CASH ALLOWANCES

1. Include in Contract Price specified cash allowances.
2. Cash allowances, unless otherwise specified, cover net cost to Contractor to cover the of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation and other authorized expenses incurred in performing Work.
3. Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
4. Contract Price will be adjusted by written change order to provide for excess or deficit to each cash allowance.
5. Include progress payments on accounts of work authorized under cash allowances in in DCC Representative's monthly certificate for payment.
6. Prepare schedule jointly with DCC Representative and Contractor, to show when items called for under cash allowances must be authorized by DCC Representative for ordering purposes so that progress of Work will not be delayed.
 - a. All Work required under this cash allowance is included in the calendar days to reach Substantial Completion, as defined in the contract **Acknowledgement Document**.
7. Amount of allowance, for Work specified below and executed by various specification sections is as follows:
 - a. Include in Contract Price an allowance of **\$25,000.00** to capture any labour & material costs, charges and fees to connect and energize the power distribution system to the transformer. This cost is to be paid by the Contractor directly to Kingston Hydro.
 - i. Reference Package A Drawing L-KN-ZKN99-511-A General Note 3.

2 PRODUCTS

2.01 NOT USED

- .1 Not Used.

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SECTION 01 21 00
Allowances
PAGE 2

3 EXECUTION

3.01 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 For tests related to Commissioning of thermal and moisture protection, and of openings, refer to Sections 07 08 00 - Commissioning of Thermal and Moisture Protection and 08 08 00 Commissioning of Openings.

1.2 APPOINTMENT AND PAYMENT

- .1 Contractor to coordinate and pay for services of testing laboratories, including:
 - .1 Testing requirements as specified in contract documents.
 - .2 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.
 - .3 Inspection and testing performed exclusively for Contractor's convenience.
 - .4 Testing, adjustment, and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .5 Mill tests and certificates of compliance.
- .2 DCC Representative will perform their own additional quality control testing when required. Where tests or inspections by 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 Provide labour, equipment, and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify DCC Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by DCC Representative.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 DCC Representative will schedule and administer project meetings throughout the progress of the work.
- .2 DCC Representative will prepare the agenda for meetings.
- .3 Contractor shall provide physical space and make arrangements for meetings.
- .4 DCC Representative will preside at meetings.
- .5 DCC Representative will record the meeting minutes, include significant proceedings and decisions and identify actions by parties.
- .6 DCC Representative will distribute electronic copies of minutes to meeting participants and, affected parties not in attendance.
- .7 Representatives of the Contractor, Subcontractors and Suppliers attending meetings are to be qualified and authorized to act on behalf of the party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within five days after award of Contract, DCC Representative will arrange a meeting of parties in the Contract to discuss and resolve administrative procedures and responsibilities.
- .2 DCC Representative and senior representatives of the Contractor, major Subcontractors, field inspectors and supervisors are to attend.
- .3 DCC Representative will establish time and location of meeting and notify parties concerned, minimum five days before the meeting.
- .4 Agenda to include:
 - .1 Appointment of official representatives of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.19 - Construction Progress Schedules - Bar (GANTT) Chart.
 - .3 Schedule of submission of shop drawings, samples, and colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Delivery schedule for specified equipment.
 - .6 Delivery schedule for pre-ordered products and work by others.
 - .7 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .8 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

- .9 Record drawings in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 - Closeout Procedures and Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcripts of policies.

1.3 PROGRESS MEETINGS

- .1 During course of the work, the DCC Representative will hold regularly scheduled progress meetings, with minimum one meeting every two weeks, and two weeks prior to project completion.
- .2 Contractor, major Subcontractors involved in the Work and the DCC Representative to be in attendance.
- .3 DCC Representative will notify parties prior to meetings.
- .4 DCC Representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance after each meeting.
- .5 Agenda 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 effect on construction schedule and on completion date.
 - .12 Other business.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by DCC Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.

- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to DCC Representative, within 10 working days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to DCC Representative within five working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 DCC Representative will review and return revised schedules within five working days.
- .3 Revise impractical schedule and resubmit within five working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Backfill.
 - .7 Building footings.
 - .8 Slab on grade.
 - .9 Structural Steel.

- .10 Plumbing.
- .11 Lighting.
- .12 Electrical.
- .13 Piping.
- .14 Controls.
- .15 Heating, Ventilating, and Air Conditioning.
- .16 Millwork.
- .17 Fire Systems.
- .18 Testing, adjusting, and balancing.

1.6 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.7 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Provide submittals listed for review to DCC Representative. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension for such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples, and mock-ups in SI Metric units.
- .4 Where items or information are 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 considered rejected.
- .6 Notify DCC Representative at time of submission, in writing, identifying deviations from requirements of Contract Documents, stating reasons for deviations.
- .7 Allow 10 working days for DCC Representative's review of each submission.
- .8 Verify field measurements and affected adjacent Work are co-ordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by DCC Representative's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by DCC Representative review.
- .11 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data that are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Where required, submit drawings stamped and signed by professional engineer registered or licensed in Ontario.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.

- .4 Adjustments made on shop drawings 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 shop drawings as DCC Representative may require, consistent with Contract Documents. When resubmitting, notify DCC Representative in writing of 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 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 copy of shop drawings for each requirement requested in specification Sections, and as DCC Representative may reasonably request.
- .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 Submit electronic copies of test reports for requirements requested in specification Sections, and as requested by DCC Representative.
 - .1 Report signed by authorized official of testing laboratory, indicating that material, product, or system identical to material, product, or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been performed within 3 years of date of contract award for project.
- .12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by DCC Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .13 Submit electronic copies of manufacturers' instructions for requirements requested in specification Sections and as requested by DCC Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards, and safety precautions.
- .14 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by DCC Representative:
 - .1 Documentation of testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .15 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by DCC Representative.
- .16 Delete information not applicable to project.
- .17 Supplement standard information to provide details applicable to project.
- .18 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.
- .19 The review of shop drawings by DCC is for sole purpose of ascertaining general conformance with design intent.
 - .1 This review shall not mean that DCC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of

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

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

1.3 SAMPLES

- .1 Submit samples for review in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to DCC Representative's business address.
- .3 Notify DCC Representative in writing, at time of submission, of deviations in samples from requirements of Contract Documents.
- .4 Adjustments made on samples by DCC Representative are not intended to change Contract Price. If adjustments affect value of Work, state so in writing to DCC Representative prior to proceeding with Work.
- .5 Make changes in samples that DCC Representative may require, consistent with Contract Documents.
- .6 Reviewed and accepted samples will become standard of quality of work and material against which installed Work will be verified.

1.4 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit construction photographs in accordance with procedures and requirements specified in this Section.
- .2 Submit progress photographs in digital format:
 - .1 Format: .jpg (quality: 80% minimum).
 - .2 Resolution: 2048 x 1536 pixels.
- .3 Compatibility: Microsoft Windows.
- .4 Identification - file name to include:
 - .1 date of exposure (year-month-day)
 - .2 project name, room number
 - .3 cardinal direction
- .5 Viewpoints: interior and exterior locations: viewpoints determined by DCC Representative.
- .6 Frequency: weekly - e-mail digital photos to DCC Representative.
- .7 Ensure photographs are focused and legible, with correct light exposure. Use a flash where necessary.

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 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 Chief Fire Prevention Officer (CFPO) or his designated representative before work starts.

1.3 REPORTING FIRES

- .1 The Contractor shall inform the DCC Representative and CFPO 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 Fire Department as follows:
 - .1 Activate nearest fire alarm pull station.
 - .2 Call 911.
 - .3 Call DCC Representative & Chief Fire Inspector by contacting 613-541-5010 x 5795 / Cell: 613-484-8166
- .4 Person activating fire alarm pull station will remain at the front entrance to direct Fire Department to scene of fire.
- .5 When reporting fire by telephone, give location of fire, name or number of building and (must give municipal address) be prepared to verify location.

1.4 FIRE SAFETY PLAN

- .1 Submit fire safety for the construction site prior to commencement of construction work. The fire safety plan shall conform to the National Fire Code of Canada.
- .2 The fire safety plan shall be limited to the area of construction only. Fire safety plan shall contain building-specific details for planned system impairments. Contractor is not responsible for amending fire safety plans in existing buildings.
- .3 The fire safety plan shall be submitted to the DCC Representative for review by Chief Fire Inspector. Allow 10 working days for DND review. Any comments by CFB Kingston Chief Fire Inspector shall be implemented by the Contractor.
- .4 Post the fire safety plan at entrance to the construction site or near 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 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 supervisory staff and other occupants in their responsibilities for fire safety.
 - .4 Documents including diagrams, showing type, location and operation of building fire emergency systems.
 - .5 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.

1.5 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 building.

1.6 INTERIOR AND EXTERIOR FIRE PROTECTION AND ALARM SYSTEMS

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

1.7 FIRE PROTECTION SYSTEM IMPAIRMENT

- .1 Notify the DCC Representative and the CFPO 48 hours 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, per the Contractor's fire safety plan a fire watch shall be required and provided by the Contractor.
- .3 The quantity of personnel involved in the fire watch is to be adequate such that the Contractor's entire area of construction work is patrolled during the fire watch.
- .4 The building shall be patrolled at least once per hour on a 24-hour basis until the fire alarm and or fire protection system has been restored to normal operation condition.
- .5 Fire watch personnel are to be familiar with facilities and procedures for sounding an alarm in the event of a fire and have a means of notifying the Emergency Services. The person(s) performing fire watch are not permitted to perform any other duties at the same time.
- .6 Fire watch personnel are to have fire-extinguishing equipment readily available and be trained in its use.
- .7 Implement all fire protection system impairments in accordance with the National Fire Code of Canada and Base Fire Orders.

1.8 FIRE EXTINGUISHERS

- .1 In addition to other requirements of this specification, supply fire extinguishers, as scaled by the CFPO, 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 CFPO.
 - .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 CFPO.
- .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.

1.9 INSTALLATION OR REPAIR OF ROOFS

- .1 Notify the CFPO of location of asphalt kettles and dates that kettles will be in use. Ensure personnel use and take precautions as follows:
 - .1 Use kettles equipped with thermometers or gauges in good working order.
 - .2 Locate kettles in safe place outside of building or, if approved by CFPO, on non-combustible roof. Locate to avoid danger of igniting combustible material below.
 - .3 Maintain continuous supervision while kettles are in operation and provide metal covers for kettles to smother flames in case of fire. Provide fire extinguishers as required in 1.08.
 - .4 Prior to start of work, demonstrate container capacities to CFPO.
 - .5 Use only glass fibre roofing mops.
 - .6 Do not leave used roofing mops unattended on roof. Store mops away from building and combustible materials.
 - .7 Store roofing materials no closer than 3.0 metres from structures.
 - .8 Any flammable cylinder shall be secure to prevent accidental tip over.

1.10 ACCESS FOR FIRE FIGHTING

- .1 Access for firefighting shall be provide in accordance with National Fire Code of Canada.
- .2 Advise the CFPO of work that would impede fire apparatus response. This includes violation of minimum horizontal and overhead clearances, as prescribed by the CFPO, erecting of barricades and digging of trenches.
- .3 Minimum horizontal clearance: clear width of not less than 5.0 meters or as defined by the CFPO.
- .4 Minimum vertical clearance: overhead height of not less then 6.0 meters, or as defined by the CFPO.

1.11 SMOKING PRECAUTIONS

- .1 Smoking is prohibited in all buildings. Observe posted smoking restrictions near existing buildings. Smoking areas will be IAW Base Fire Orders and will not be within 10 meters of any building entrance.

1.12 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 as directed.

- .4 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.
- .5 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove specified.

1.13 FLAMMABLE AND COMBUSTIBLE LIQUIDS

- .1 Handle, store and use flammable and combustible liquids in accordance with 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 CFPO for storage of quantities of flammable and combustible liquids exceeding 45 litres on site.
- .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 CFPO when disposal is required.

1.14 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 CFPO prior to and at completion of such work.

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 through their DCC Representative from the CFPO 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 CFPO. Request to be submitted 48 hours in advance of any hot work.
- .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 CFPO.
- .4 Provide fire watch service for work on scale established and in conjunction with the CFPO as defined in the Fire Department Briefing. Fire watchers shall be trained in the use of fire extinguishing equipment. The person(s) performing fire watch are not permitted to perform any other duties at the same time.
- .5 Area of hot works
 - .1 Hot works shall be carried out in an area free of combustible and flammable content.
 - .2 Where 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 CFPO.
 - .3 A final inspection of the hot work area shall be conducted 1 hour after the completion of hot works unless otherwise directed by the CFPO.
 - .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.
- .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 CFPO.
- .8 Temporary heating
 - .1 No open flame heaters can be used on construction site.

- .2 Only forced air heaters ULC or CSA approved and rated for industrial or construction use shall be used.
- .3 All electric heaters shall be connected on a proper and individual circuit.

1.16 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 the Departmental or Canadian Forces personal. 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 National Fire Code.
- .3 A watch, with tours at intervals of not more 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 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.

1.17 FALSE ALARM FEES

- .1 "False Alarm" is the activation of a Fire Alarm System or emergency system through a mechanical failure, equipment malfunction, improper installation of the system or failure to maintain the system as described by the Ontario Fire Code being O.Reg.388/97, under the Fire Protection and Prevention Act, 1997, S.O. 1997, c.4, as amended.
- .2 The Contractor shall not undertake work on any Fire Alarm System that sends an alarm directly to the Kingston Fire & Rescue or a Fire Alarm Monitoring Service without the DCC Representative being notified 48 hours in advance first.

1.18 QUESTIONS OR CLARIFICATION

- .1 Direct questions or clarification on Fire Safety in addition to above requirements to the DCC Representative.
- .2 DCC Representative is responsible to obtain clarification from the CFPO. The Contractor is not to liaise directly with the CFPO for notification, authorization or any requests unless the situation constitutes an immediate emergency.

1.19 FIRE INSPECTION

- .1 Co-ordinate site inspections by CFPO through DCC Representative.
- .2 Allow CFPO unrestricted access to work site.
- .3 Co-operate with CFPO during routine fire safety inspection of work site.
- .4 Immediately remedy unsafe fire situations observed by CFPO.

END OF SECTION

1 **References**

FEDERAL

- .1 Applicable Base Environmental Administrative Instructions (AI) or Base Standing Orders (BSOs) will be provided to the Contractor after award.
 - .1 BSO 16.01 – Emergency Environmental Response.
 - .2 BSO 16.03 – Management of POL Storage Tank Systems.
 - .3 BSO 16.04 – Halocarbon Management – Infrastructure.
 - .4 BSO 16.06 – Hazardous Materials General Requirements.
 - .5 BSO 16.10 – Natural Resources.
 - .6 BSO 16.11 – Archaeological Resources.
 - .7 BSO 16.12 – Soil Management.
- .2 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.
- .3 *Canadian Environmental Protection Act 1999*. Statutes of Canada 1999 Chapter 33.
 - .1 Federal Halocarbon Regulations, 2022. SOR/2022-110.
 - .2 Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations. SOR/2008-197.
- .4 *Canada Labour Code- Canadian Occupational Health and Safety Regulations* (SOR/86-304). 2019.
- .5 *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.

- .6 *Code of Practice for the Environmental Sound Management of End-of-Life Lamps Containing Mercury*. Environment and Climate Change Canada. 2017.
- .7 *Fisheries Act*. Revised Statutes of Canada 1985, Chapter F-14.
- .8 *Migratory Birds Convention Act, 1994*.
- .9 *Migratory Birds Regulations, 2022*.
- .10 *Transportation of Dangerous Goods Act* and pursuant regulations.

PROVINCIAL

- .11 *Ontario Water Resources Act*. Revised Statutes of Ontario 1990, Chapter O.40.
- .12 *Technical Standards and Safety Act, 2000* and pursuant regulations, codes, and standards. Statutes of Ontario 2000, Chapter 16.
- .13 *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 406/19. *On-site and Excess Soils*.
 - .6 Ontario Regulation 407/19. *Records of Site Condition*. Part XV.1 of the Act.
- .14 Ontario Provincial Standard Specifications. Ontario Ministry of Transportation.
 - .1 OPSS 518. Construction Specification for Control of Water from Dewatering Operations.

- .2 OPSS 801. Construction Specification for the Protection of Trees.
- .3 OPSS 805. Construction Specification for Temporary Erosion and Sediment Control Measures.

MUNICIPAL

- .15 Corporation of the City of Kingston By-Law No. 2008-192 "*A By-Law to Provide for the Regulation of Waste Water Services and Discharges to Municipal Sewers for the City of Kingston*".
- .16 City of Kingston By-Law No. 2004-52 "*A By-Law to Regulate Noise*".

2 Related Sections

- .1 01 35 43.01 Soil Management
- .2 01 74 19 Waste Management and Disposal

3 Submittals

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities submit an Environmental Protection Plan (EPP). The EPP must meet the intent of the contract and must be acknowledged as reviewed by the DCC Representative prior to work commencement.
- .3 The Environmental Protection Plan to include the following sub-Plans:
 - .1 Spill Prevention Response Plan (SPRP).
 - .2 Erosion and Sediment Control Plan (ESCP).
 - .3 Soil Management Plan (SMP).
 - .4 Waste Management and Disposal Plan (WMDP).
- .4 Submit other data, information and documentation upon request by the DCC Representative and as stipulated elsewhere in this section.

4 General

- .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 Environment Officer, or designate, as well as, 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 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.
- .9 In accordance with the City of Kingston Noise By-law, noise due to construction is not permitted from 7 p.m. through 7 a.m., and all day on Sundays and statutory holidays.

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 Plan (SPRP) prior to work on-site.
 - .1 The SPRP shall include environmental response measures necessary to prevent and to mitigate a pollutant release on National Defence property.

- .2 The SPRP is to include:
 - .1 Contact information for the designated qualified individual to be the Environmental Protection Coordinator (EPC).
 - .2 Roles and responsibilities including names of those responsible for managing the SPRP.
 - .3 List of all subcontractors including contact information to support the SPRP.
 - .4 Notification to the DCC Representative for any spill.
 - .5 Emergency spill response measures, see 5.6 below.
 - .6 Project and site-specific clean up measures for spills,
 - .7 Waste disposal, including disposal procedures for materials used to contain the spill and storage location for these materials.
 - .8 Procedure to escalate for spills beyond Contractor's ability to manage the spill.
 - .9 Refueling operations shall be conducted within a secondary containment area. Refuel equipment no closer than 30 metres from water bodies. SPRP shall identify equipment fueling location, the machinery to be refueled, location of transfer area, methodology and control measures during refueling.
- .3 Identify storage locations of materials or wastes that may require emergency spill response. Identify spill control kit inventory and location(s).
- .3 The SPRP 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 An CFB Kingston Pollution Incident Report as per BSO 16.01 shall be completed by the Contractor for all spill or release incidents and submitted to the DCC Representative.
- .6 Emergency Response:
 - .1 With respect to liquid spills, contractor shall have on-site equipment to control a liquid spill of 110% of any material brought on to—or handled at—the site for one (1) hour.
 - .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.
 - .1 A spill control kit shall be located wherever 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 SPRP Plan and make immediate notifications to 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.
- .7 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.

6 Erosion and Sediment Control Plan

- .1 Establish and submit to the DCC Representative an Erosion and Sediment Control Plan (ESCP) prior to start of work on-site. The ESCP must be updated, modified and resubmitted at the direction of the DCC Representative as necessary if existing sediment and erosion control measures are proving inadequate.
 - .1 ESCP to include the following information:
 - .1 Name and contact information for designated qualified individual to be the Environmental Protection Coordinator.
 - .2 Any subcontractors and contact information to support the ESCP.
 - .3 A drawing showing location of site work that requires erosion and sediment controls and type to be installed. Include location of stockpiles, laydown areas for machinery/materials and dewatering locations.
 - .4 A schedule of work for installation, monitoring, and removal.
 - .5 Sample checklist and details of how and when inspections will be performed to ensure control measures follow the contract documents.
 - .6 All erosion and sediment control measures must 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.
 - .7 A list of municipal, provincial and federal permits and/or notifications the Contractor must obtain (as per the contract documents) to complete the work.
 - .8 Emergency procedures in the event of a failed Erosion and Sediment Control measure.
 - .2 Contractor to submit, to the DCC Representative, and maintain a record 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, at time of any 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 the record for each ESC measure.
- .3 Ensure control measures are in compliance with ESCP and Federal, Provincial and Municipal laws and regulations.
- .3 Dewatering systems must be capable of controlling ingress of water during work, as well as prevent surface runoff into excavation.
- .2 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.
- .3 Berm barriers are not permitted.
- .4 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.
- .5 Have additional sediment control materials readily available in case they are needed promptly for erosion and sediment control.
- .6 Maintain sediment controls in good condition until terrestrial vegetation has re-established.
- .7 Remove captured sediment before dismantling sediment barriers.

7 Waste Management and Disposal Plan

- .1 Submit a Waste Management and Disposal Plan (WMDP) to the DCC Representative before construction work begins at the site. The WMDP is to comply with legislation, best practices, and with the requirements of the specifications.

.2 The WMDP is to encompass requirements detailed in Section 01 74 19 as applicable, as well as:

- .1 Regular waste,
- .2 Hazardous materials used in the course of the work, and
- .3 Hazardous materials and designated substance waste.

.4 The WMDP shall include items below in addition to 7.3 through 7.8

- .1 Name and contact information for the designated individual responsible for the WMDP.
- .2 A list of all contractors and Receiver Facilities for all waste types.
 - .1 Waste carriers' business name, address, telephone, email address, and MECP Certificate(s) of Approval listing the hazardous materials approved for transportation.
- .3 The anticipated waste shipment frequency for all waste.
- .4 Detailed procedures to be used to manage all waste products stored on site (petroleum, oil, lubricants and other hazardous waste to be detailed specifically). Include types of containers, labeling and segregation)
- .5 A description of the types of waste materials and expected quantities for storage, transport and disposal. For leachate toxic waste include detailed compliance with O.Reg 347 and Transportation of Dangerous Goods Act (TDGA).
 - .1 Include procedure for notifying DCC Representative of the transport of hazardous materials and/or designated substances (including asbestos) offsite.
- .6 Procedures for storing and release of hazardous materials to be removed from site including manifest procedures.
- .7 Procedures that detail requirements for the below Special Substances that detail what is contained in the specification.

- .1 Mechanical Flushing Liquids to Sanitary Sewers including lab analysis report, notifications and contacts.
- .2 Smoke detectors
- .3 Polychlorinated Biphenyls (PCBs)

.3 Waste Handling:

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

.4 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 always kept neat and orderly.

.5 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.

.6 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.

.7 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 Contractor proposed date and time for hazardous waste material shipment.
 - .3 Correspondence from the approved hazardous waste receiver, indicating agreement and intent to accept the specified hazardous materials waste on specified date.
 - .4 Contractor will complete a "Certificate of Content for Waste Disposal" provided in Item #18 of 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.
- .8 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 City of Kingston Sewer Bylaw Schedule A 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 City of Kingston 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.
- .9 Do not bury rubbish or waste materials on DND Property.
- .10 Do not dispose of waste into any waterways, storm or sanitary sewers, drainage system, or onto land.
- .11 Divert unused asphalt material from landfill to be reused offsite or recycled.
- .12 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.
- .13 All expenses incurred for the handling, storage, analysis, transport and disposal/recycling of all wastes will be incurred by the Contractor.

8 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; and for bidding purposes assume there are five (5) 30cm diameter trees for removal.

- .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.
- .11 Two (2) trees of native species will be planted for every one (1) tree removed from the Site.

9 Wildlife Protection

- .1 Nesting structures in trees for birds of prey are to remain intact without harm to the tree or 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 and the *Migratory Birds Regulations*, 2022.
- .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.

10 Soil Management

- .1 Refer to section 01 35 43.01 Soil Management.

11 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 Waterbodies:
- .1 Chlorinated drinking water is considered a deleterious substance by Environment and Climate Change Canada (ECCC).
 - .1 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).
 - .2 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.

12 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.

13 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.

14 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.

15 Archaeology

- .1 Artifacts can include broken housewares, garbage, bits of uniforms, ships or boats, timber, ammunition, building materials, building foundations, cut stone, stone drains, animal bones, human bones, coins or tokens, ash pits, fire pits, encampments, Aboriginal materials, pottery, etc.
- .2 During excavations, watch for the following: patterns; off-colour soils (either light or dark); any sorts of the artifacts noted above.
- .3 Excavations must coincide with the archaeology field period, from April until November.
- .4 Upon discovery of artifacts, stop work in that area and notify the DCC Representative.
- .5 An archaeologist licensed in Ontario will monitor all excavation work or disturbance of the existing ground.
 - .1 Coordinate through the DCC Representative for monitoring of excavations by the archaeologist.
 - .2 A minimum 48 hours notice is required for any excavation in which archaeological monitoring has been stipulated.
- .6 Expect interruptions of excavation work by the archaeologist of up to 2 hours per day. Interruptions for longer periods will be negotiated between the General Contractor and the DCC Representative, in accordance with the General Conditions of the contract.

16 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.

17 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 designated by the Contractor prior to work commencing on Site.
- .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 CFB Kingston. Obtain forms from DCC Representative. Mount forms upon equipment.
- .7 Affix bar code tags to the equipment, as provided by the DCC Representative.
- .8 Immediately report all releases of halocarbons to the DCC Representative.
 - .1 Complete Base incident reporting form and provide to DCC Representative within 24 hours.
- .9 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*.
- .10 Leak-test all “empty” equipment within 24 hours of arrival at the Base, in accordance with the FHR 2022 and the *Refrigeration Code of Practice*.
- .11 Leak-test halocarbon-containing equipment during Commissioning in accordance with the FHR 2022 and the *Refrigeration Code of Practice*.
 - .1 Complete Base activity log forms; to be provided by the DCC Representative.
- .12 After installation, leak-test factory-charged halocarbon-containing equipment in accordance with the FHR 2022 and the *Refrigeration Code of Practice*.
 - .1 Complete Base activity log forms; to be provided by the DCC Representative.
- .13 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.

.14 Example Halocarbon Service/Activity Log Form (Hard Copy to be Submitted Will be Provided After Award)

2025-01-24

Annex B to

Sequential Form Number:

BSO 16.04

Refrigeration and Air Conditioning Service Log (CFB Kingston)

For this type of work...	...complete these items in these Sections			
	A	B	C	D
Commissioning	All	All	1.0, 1.1, 1.2, 3.0	1 through 8, 13
Leak Test	All	All	All	1, 2, 3, 5, 6, 7, 13
Servicing of Sealed Systems Only (Refrigerant Circuit)	All	All	All	1 through 9, 13
De-Commissioning	All	All	Not applicable	1, 2, 5 through 13

SECTION A.

Decommissioning

☐ Commissioning

☐ Leak Test

☐ Servicing

☐

Building No. _____ Operator _____

Room No. _____ Owner _____

Owner Address _____

Equipment Description _____ DND Barcode No. _____

SECTION B.

Work Order No. _____ Service Date _____

Model Number _____ Serial Number _____

Contracting Company/Technician Employer _____

Technician/Contractor Name (print) _____

Technician's Trade Certificate No. _____ Expiry Date _____

SECTION C.

ACTIVITY	YES	NO	COMMENTS
1.0 Leak Test Performed			Date of Last Leak Test: _____
1.1 Leak(s) Detected			
1.2 Leak(s) Repaired			
2.1 Halocarbon Recovered From System			
2.2 Halocarbon Isolated in System			
3.0 System Charged With Halocarbon			FACTORY ☐ FIELD ☐

SECTION D.

1. Technician's ODS Awareness Card No. _____ Expiry Date _____

2. Type of Halocarbon _____

3. Halocarbon Charge Capacity _____ (kg) (lb) (oz). Amount of Halocarbon Charged _____ (kg) (lb) (oz)

4. Charged by: ☐ Contractor ☐ Factory ☐ DND (give DND cylinder barcode No. _____)

5. Cooling Capacity of System _____ (tonnes) (BTU) (kW)

6. Halocarbon charged per circuit (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (kg) (lb) (oz)

7. Type of Halocarbon Recovered _____

8. Amount of Halocarbon Recovered _____ (kg) (lb) (oz)

9. Recovered into cylinder owned by: ☐ Contractor ☐ DND (give DND cylinder barcode No.) _____

10. Final Destination of Equipment _____

11. Final Destination of Halocarbon _____

12. Final Destination of Refrigerant Oil _____

13. Technician Signature _____

Submit form to DCC Representative, 6 Moro St. Fax 546-5118. WHITE (Top) – Attach to equipment

YELLOW – RM Supervisor PINK – B Env O

GOLDENROD -Technician

18 Certificate of Content for Waste

Date: _____

DCC/CE Project Number: _____

Site Location: _____

Contractor Name: _____

Address: _____

Contact Name: _____

Phone Number: _____

Brief Description of Materials Being Shipped (including quantity):

This document is to certify that the materials being shipped are as described above.

Only materials indicated on this Certificate as described above will be shipped. For materials requiring manifests a minimum of 48 hours notice is required to coordinate Base Environment sign-off prior to material transport from site.

If applicable indicate,

Manifest #: _____

Waste Classification#: _____

Contractor Signature (print and sign):

DCC/CE Contract Authority (print and sign): _____

Ref.

Ontario Regulation 347/558

Transportation of Dangerous Goods Act

Submit form to DCC Representative

END OF SECTION

1 **References**

FEDERAL

- .1 Applicable Base Environmental Administrative Instructions (AI) or Base Standing Orders (BSOs) will be provided to the Contractor after award.
 - .1 DCS CSI (CSI.004.001) - Soil Management. V. 4.1, 28 March 2024.
 - .2 BSO 16.12 Soil Management.
- .2 Canadian Council of Ministers of the Environment (CCME). *Canadian Environmental Quality Guidelines (CEQGs)*.
- .3 *Canadian Environmental Protection Act 1999*. Statutes of Canada 1999 Chapter 33.
- .4 Health Canada's drinking water guidelines and screening values. June 2024.
- .5 *Transportation of Dangerous Goods Act* (S.C. 1992, c. 34) 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 Soil Management.

- .8 Landscape Ontario Horticultural Trades Association 2004 (LOHTA 2004). *Landscape Guidelines, 2004 Edition - Chapter 5 Topsoil Guidelines*.
- .9 Ministry of the Environment, Conservation and Parks (MECP, 2020) *Rules for Soil Management and Excess Soil Quality Standards*.
- .10 Ontario Ministry of Transportation. Ontario Provincial Standard Specifications (OPSS). Technical Publications.
- .11 Ontario Water Resources Act. Revised Statutes of Ontario 1990, Chapter O.40.
- .12 Technical Standards and Safety Act, 2000 and pursuant regulations, codes, and standards. Statutes of Ontario 2000, Chapter 16.

2 Related Sections

- .1 01 35 43 Environmental Protection

3 Submittals

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing any construction activities, the following submittals are to be submitted and confirmed by the DCC Representative:
 - .1 Soil Management Plan (SMP). See Section 5 for minimum mandatory contents of the SMP.
 - .2 As part of the SMP, the Contractor is required to submit a Soil Sampling Plan (SSP). See Section 5.7 for minimum mandatory contents of the SSP.
- .3 Approval of the SMP from the DND Representative is required prior to work commencing on site.
- .4 The Contractor will allow up to 10 business days for review of the SMP by DCC and DND Representatives.

- .5 Prior to the movement of soil from the Work Site, the following submittals are to be submitted and confirmed by the DCC Representative:
 - .1 Soil Characterization Report (SCR) which will present the analytical results obtained from the SSP compared to the appropriate standards and discuss reuse and/or disposal options for the excess soils.
 - .2 Update the SMP to include Section 5 contents not known prior to the commencement of construction activities.
 - .3 The Contractor will allow up to 10 business days for review of the SCR by DCC and DND Representatives.
- .6 Submit other data, information, and documentation upon request by the DCC Representative and as stipulated elsewhere in this section.
- .7 All soil movement on or off DND Property must be tracked. Submit at contract close out a Summary Soil Management Tracking Report to include soil volumes, transported and disposed, Source and Receiver Site location and soil movement dates.

4 General Soil Management

- .1 Comply with all federal, provincial, and municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, as noted in Section 1 References.
 - .1 All references to payment referred to in OPSS references are to be disregarded and do not apply to this contract.
- .2 The Work Site is subject to inspection by the Base Environment Officer, or representative, 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 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 Blasting is not permitted on DND property.
- .7 Fires and burning of rubbish are not permitted on DND property.

5 Minimum Soil Management Plan (SMP) Requirements

- .1 A Qualified Person (QP) will be retained by the contractor to complete the SMP.
- .2 The SMP will include soil characterization results from the SCR, estimated soil/fill quantities, considerations for water table excavations, disposal options for excess soil, stockpile locations and management plan with figures, decontamination procedures and soil re-use plan. Details for SMP requirements are listed in sections 5.3 through 5.7 below.
- .3 **Contact Information and Responsibilities**
 - .1 Provide contact information the Qualified Person (QP) as per O. Reg. 153/04 and O. Reg. 406/19 who will sample and characterize any excess soil or fill material to be removed or imported from the Work Site.
 - .2 Provide sub-contractor/consultant contact information to support the SMP.
 - .3 SMP to be signed by the Qualified person.
- .4 **Imported Soil/Fill to the Work Site**
 - .1 Documentation on imported fill will be reviewed by the DCC Representative and DND Environment Officer representative prior to bringing to site.
 - .2 Provide the source location from which the imported fill came from.
 - .3 Provide a description of the type of imported material (Granular A, stone dust, crusher run, etc.).

- .4 Determine if the material is exempt from environmental testing, whereby, due to the low risk of some activities and material sampling is not required. See Section 8 for sampling exemption details.
- .5 In cases where fill material is not exempt, provide a letter report from the Source Site (prepared and signed by a QP) meeting CCME criteria as per the contract, for imported fill material.
 - .1 Letter to include:
 - .1 Name, address and Ontario license number of source quarry/pit.
 - .2 Land Use Classification of imported fill destination.
 - .3 Confirmation that the material is from a virgin source and not recycled.
 - .4 Confirm that the number of samples meets O. Reg. 153/04.
 - .5 Certificates of Analysis from laboratory.
 - .6 Sampling methodology and QA/QC adhered to.
 - .7 Summary table of analytical results, highlighting any exceedances to the applied Land Use Classification (CCME CEQG) for parameters outlined in the contract.
 - .8 Any sampling plan changes and results of sampling.
- .5 **Excess Soil/Fill Disposal Off the Work Site**
 - .1 For excess soil transport and disposal, including contaminated soil, provide:
 - .1 The Receiver facility contact information (name, address, email, phone number).
 - .2 Environmental Compliance Approval (ECA).
 - .3 Provide a letter of acceptance from the Receiving Site based on analytical results.
 - .4 Include submittals of manifest copies and weigh bills.
 - .2 Detail sampling requirements as per O. Reg. 153/04 and O. Reg. 406/19 for excess soils to be removed or disposed of from the Work Site. Include the following:

- .1 The number of samples, and sampling methodology as per O. Reg. 153/04.
- .2 Contaminant parameters to be sampled as per the contract.
- .3 Confirmation of the use of Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for sample analysis.

.6 Soil Reuse at the Work Site

- .1 Explain procedures for managing soils to be reused at the Work Site which includes stockpiles and handling of soil.
 - .1 Details to include covering stockpiles to prevent water intrusion, mixing avoidance, deposit location of stockpiles, separation of topsoil from vegetation and from other soils (e.g. imported, excess, contaminated).
 - .2 For additional procedural requirements refer to section 6 of this specification.

.7 Soil Sampling Plan to include:

- .1 For the importation of material that non-exempt from sampling, or characterizing additional soils above what has been previously characterized, the following shall be included:
 - .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 meet applicable provincial and federal standards, as well as sampling methodologies.
 - .3 Locations of samples collected.
 - .4 A description of the type imported material (aggregate, fill) and proposed quantity.
 - .5 For the characterization of ex-situ or in-situ excess soils, the provincial and federal regulatory requirements are to be followed.
- .2 All samples shall be submitted to a CALA or similar accredited laboratory for analysis.

6 Management of Reuse and Excess Soil

- .1 Soil Characterization has been completed previously in accordance with federal and provincial laws for the project area as defined in the scope of work, this will be provided after contract award. Results indicated that soils generally met CCME Residential standards, with the exception of one (1) exceedance of chromium (result of 65 µg/g, compared to the CCME residential standard of 64 µg/g) as well as an exceedance of phenanthrene (result of 0.33 µg/g compared to the CCME residential standard of 0.046 µg/g with the protection of freshwater applied). Results also indicated that the soils did not meet MECP Table 2.1 standards due to exceedance in barium and cobalt. The results indicated that soils met MECP Table 3.1 standards. Leachate results (both mSPLP and TCLP) indicated the materials were not leachate toxic. Communications with the Contaminated Site Manager have indicated that given the minor exceedance in chromium and removing the freshwater protection for phenanthrene (CCME standard then becomes 5 µg/g), that the soil can be reused on-Site. Based on this soil characterization, it is estimated that excess soils can be reused at the Work Site. Any soils deemed to be excess which cannot be reused on-Site should be transported to a reuse site which will accept them, or disposed of as non-hazardous solid waste at an appropriately licensed facility.
- .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 Work Site, O. Reg. 406/19 will be adhered to.
- .3 Excavated materials leaving the Work Site above the quantity previously characterized must be environmentally characterized under the supervision of a QP and disposed of in accordance with provincial and federal standards.
 - .1 Parameters to be analyzed for the soil samples collected are defined in Section 9.3 of this specification. These parameters will be used for removal/disposal offsite and potential reuse of soil on the Work Site.
 - .2 The Contractor will provide DCC with written documentation from the Receiving Site confirming that excess soil will be accepted at the facility based on the soil analytical results.

- .3 The Contractor will provide the DCC Representative with copies of all manifests, weight tickets and waste hauler and disposal licenses.
- .4 All temporary stockpiled soil and aggregate material 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 sensitive receptors (e.g. waterbodies) and property boundaries.
 - .2 All stockpiles must be inspected on a regular schedule and maintained, as per the Soil Management Plan.
 - .3 Water contained in the stockpiled soil must be properly contained and managed to prevent contaminated water from running off into the environment.
- .5 Prevent disturbance and compaction of topsoil and underlying soil from vehicles and heavy equipment using load dispersion materials.

7 Slurry Management

- .1 To limit slurry production, air vacuum excavation and/or hand digging should be used whenever possible.
- .2 Soils to be removed from a known or suspected contaminated site by hydrovac must be characterized prior to removal.
- .3 If the soils in question contain (or are assumed to contain) PFAS, then hydrovac methods cannot be used unless a disposal option is determined prior to hydrovac.
- .4 If the slurry cannot be tested until after it's generated, then it must be temporarily stored in drums, tested, then disposed of accordingly.

8 Importing Fill Material

- .1 All aggregate/fill materials imported onto DND property must be uncontaminated.
- .2 The Contractor is to confirm prior to importing fill material that there are no visual or olfactory indications of contamination.

- .3 All fill materials will require sampling and laboratory analysis in accordance with section 9.3, except the exempted materials listed below. These materials must be from a virgin source and not be recycled.
 - .1 Topsoil (please see points 8.7 through 8.11 below for topsoil requirements regardless of exemption);
 - .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, as per section 5.4.5, stating that the imported fill material meets CCME Agricultural Land use criteria or acceptable ambient background conditions based on intended use.
- .7 While exempt from analytical testing as described in section 9.3, in accordance with BSO 16.12 topsoil shall be fertile, friable, sandy loam topsoil as per Table 5-1 Properties of Growing Medium, **Chapter 5 Landscape Guideline: Landscape Ontario Horticultural Trades Association 2004**. A mixture of subsoil and shall be free of stones over 30 mm in diameter, debris, organic or other deleterious contaminants and fragments larger than 75 mm in size, plants or their roots, sticks, noxious weeds, salts, soil sterilants or other materials detrimental to plant growth.
- .8 Topsoil will have a salt conductivity of less than 2 millisiemens/cm.
- .9 Soil amendments must be free from clay subsoil, sawdust, commercial wood products, stones, lumps, plants, roots, sticks, weed

stolons and seeds, high seed content, chemical contaminants and other materials harmful to plant life.

- .10 Topsoil and soil amendments will meet the mechanical analysis as set out in Table 5-2, Chapter 5 Landscape Guidelines: Landscape Ontario Horticultural Trades Association 2004 (LOHTA 2004).
- .11 Contractor is required to submit analytical data from an Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) or CALA accredited commercial lab demonstrating requirements outlined Table 5-1 are met prior to bringing topsoil to site. Contractor is required to provide information 10 business days prior to bringing to site.

9 Sampling and Test Results

- .12 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/fill materials to be removed from or imported to the Work Site that has not already been characterized within the contract documents.
 - .1 Sampling plan to be prepared as per MECP Rules of Soil Management and Excess Soil Quality Standards (section B (3), pg.16).
 - .2 See Section 5.7 for minimum, mandatory Soil Sampling Plan content.
- .13 All samples are to be tested at a minimum for the following contaminant parameters:
 - 1. Polycyclic Aromatic Hydrocarbons (PAHs),
 - 2. Volatile Organic Compounds (VOCs),
 - 3. Petroleum Hydrocarbons (PHCs)
 - 4. Benzene, toluene, ethylbenzene, xylenes (BTEX)
 - 5. Metals and Inorganics.
- .14 Sampling frequencies will be in accordance with applicable and current Federal and Provincial regulations.

10 Unanticipated Soil Contamination

- .1 Refer to contract General Condition.

- .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 SUMMARY

- .1 Delegated Design Submittals shall account for professional engineering responsibility for design, review and acceptance of components of Work forming a part of permanent Work in accordance with National Building Code and that has been assigned to a design entity other than DCC Representative including, but not limited to, the following:
 - .1 Design requiring structural analysis of load bearing components and connections.
 - .2 Design requiring compliance with fire safety regulations.
 - .3 Design requiring compliance with life or health safety regulations.
- .2 Delegated Design Submittals are not required for components of Work requiring engineering for temporary Work (such as crane hoisting, engineered lifts, falsework, shoring, concrete formwork) that would normally form part of Contractor's scope of Work.
- .3 Requirements of this section do not change or diminish responsibilities of DCC Representative. Submittals will be used by DCC Representative to establish that Work meets or exceeds the requirements of NBC.

1.2 DELEGATED DESIGN

- .1 Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated where professional design services or certifications by a design professional are specifically required of Contractor by Contract Documents.
- .2 If criteria indicated are not sufficient to perform services or certification required, submit written request for additional information to DCC Representative.
- .3 Delegated design is required for elements designed by a specialty professional, loads as determined in accordance with National Building Code requirements, which include but are not limited to the following:
 - .1 Elements normally fabricated off-site.
 - .2 Elements that require specialized fabrication equipment or a proprietary fabrication process not usually available at job site.
 - .3 Elements requiring engineering not normally part of scope of services performed by architectural, structural, mechanical, or electrical disciplines of DCC Representative.

1.3 SUBMITTALS

- .1 Product Data, Shop Drawings and Samples: Comply with requirements in Section 01 33 00 – Submittal Procedures for each product of Delegated Design portion of work. Product submittals are in addition to submittals for permit and design data.
 - .1 Include design criteria, design assumptions, structural calculations, fabrication and construction details, required clearances, and interface requirements.
 - .2 Affix Design Professional's seal on Submittals.
- .2 Prepare required submittals and present to DCC Representative within sufficient time to allow for DCC Representative's detailed review and acceptance.
- .3 Design requirements specific to Delegated Design portions are indicated in specification Sections that specify the component.
- .4 Engineer's Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of type indicated.
- .5 Preliminary Design: Submit drawings and product data that describe Contractor's design prior to performing engineering calculations and final drawings.
 - .1 DCC Representative will evaluate proposed design and comment on conformance with intent of Contract Documents.
 - .2 Preliminary review is for aesthetic and general function concerns and will not constitute approval of engineering.
 - .3 Purpose of this submittal is to avoid engineering and detailing an unacceptable proposal.
- .6 Final Design: Submit drawings, product data and engineering calculations that describe Contractor's final design.

1.4 LETTER OF COMMITMENT

- .1 Submit signed and sealed Letter of Commitment on company letterhead addressed to DCC Representative prior to starting Work requiring design and seal of a professional engineer.

1.5 LETTER OF COMPLIANCE

- .1 Submit signed and sealed Letter of Compliance on company letterhead addressed to DCC Representative on completion of Work requiring design and seal of a professional engineer.

END OF SECTION

Part 1 General

1.1 REFERENCES TO REGULATORY REQUIREMENTS

- .1 Perform Work in accordance with latest edition release of National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 QUALITY ASSURANCE

- .1 Regulatory Requirements: Except as otherwise specified, Constructor shall apply for, obtain, and pay fees associated with licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:
 - .1 Regulatory requirements and fees in force on date of Bid submission, and
 - .2 A change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission.

Part 2 Products

2.1 EASEMENTS AND NOTICES

- .1 DCC Representative will obtain permanent easements and rights of servitude that may be required for performance of Work.
- .2 Contractor shall give notices required by regulatory requirements.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 08 08 00 - Commissioning of Openings

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM):
 - .1 ASTM E329-23, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
- .2 International Organization for Standardization (ISO):
 - .1 ISO 9001-2015, Quality Management Systems - Requirements
 - .2 ISO 17025:2005, General requirements for the competence of testing and calibration laboratories

1.3 DEFINITIONS

- .1 Mock-Up: A full-size physical example that demonstrates materials, finishes, interrelationships of materials and assemblies, aesthetic effects, and execution. A mock-up may demonstrate coordination of multiple Subcontractors' work. A mock-up establishes a standard by which the Work will be judged. Mock-ups are not samples.
- .2 Quality Assurance: Procedures for preventing defects and deficiencies before and during execution of the Work.
- .3 Quality Audit: Systematic and independent examination to determine whether quality requirements have been fulfilled as planned. A quality audit will examine processes, products, and services to determine if they have been implemented effectively to achieve their specified objective.

1.4 SECTION INCLUDES

- .1 This Section describes administrative and procedural requirements for proactive Contractor activities to assure the quality of construction before and during execution of the Work.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Contractor is responsible for self-performed testing and inspections and submittal of test reports to DCC Representative.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit a testing and inspections schedule to DCC Representative.
- .3 Submit certificates for products, process, and system for verification by DCC Representative.
- .4 Submit formal testing and inspections reports per ASTM E329 as indicated in technical specification Sections to DCC Representative in accordance with contractual agreement.
- .5 Submit each quality assurance inspection and test report to DCC Representative.
- .6 Submit mill test certificates as required in technical specification Sections and as indicated on Drawings.

1.7 QUALIFICATIONS

- .1 Manufacturers' Qualifications:
 - .1 Specializes in manufacturing the products specified in the technical Section of the Project's construction specification.
 - .2 Documented experience with a record of successful performance.
- .2 Suppliers' Qualifications:
 - .1 Authorized to distribute manufacturer's products.
 - .2 Capacity to supply required products without delaying the Project
- .3 Fabricators' Qualifications:
 - .1 Experienced in producing products required for this Project
 - .2 Successful record of in-service performance
 - .3 Sufficient production capacity to fabricate required products without delaying the Project
- .4 Installer Qualifications:
 - .1 Firm or individual experienced in design and installation, application, and erection of materials to the extent required for this Project
 - .2 Successful record of in-service performance
- .5 Testing and Inspecting Agency Qualifications:
 - .1 Refer to Sections 07 08 00 - Commissioning of Thermal and Moisture Protection and 08 08 00 Commissioning of Openings.
 - .2 Third-party accredited testing laboratory.
 - .3 Accredited to ISO 17025.

- .4 Accredited organizations by the Standards Council of Canada for testing and inspection.
- .5 Capable of reliably performing testing of building products and inspections of construction activities in accordance with ISO 9001 and ASTM E329.
- .6 Licensed Professionals Qualifications:
 - .1 Individual registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

1.8 CERTIFICATIONS

- .1 Ensure that certification of products, processes, and systems includes physical and examination testing as specified in ASTM E329 and ISO 9001 to confirm compliance with Specifications requirements.

1.9 COORDINATION

- .1 Coordinate and schedule tests and inspections with accredited testing and inspection agencies as indicated in Contract Documents and in accordance with ASTM E329 requirements.
- .2 Coordinate Contractor's Quality Management System with DCC Representative for reporting, scheduling access and incidental labour required by Quality Auditor's reports if required.
- .3 Obtain DCC Representative approval before proceeding with tests and inspections, and additional tests and inspections as may be reasonably requested by DCC Representative.
- .4 Coordinate testing and inspections schedule with Sub-Contractor, testing agencies, and other affected parties.

1.10 SITE SAMPLES

- .1 Obtain DCC Representative 's acceptance to proceed with the sampling process.
 - .1 Testing agency is responsible for obtaining representative samples of those materials required to be tested and evaluated as directed by DCC Representative in accordance with the Contractual Documents.
- .2 Ensure testing agency performs sampling in accordance with ASTM E329.
 - .1 When sampling collection is required by testing agency, ensure proper protection, handling and storing of samples.
- .3 Testing agency to document procedures and appropriate techniques to select samples.

- .4 Record details of environmental conditions present during the sampling, such as rain or freezing weather that may affect testing of sample or interpretation of test results.

1.11 MOCK-UPS

- .1 Provide mock-ups of thermal and moisture protection systems and of openings in accordance with Section 07 08 00 - Commissioning of Thermal and Moisture Protection and Section 08 08 00 - Commissioning of Openings.
- .2 Mock-ups can be used as a reference for assessing quality of workmanship and site-applied finishes as requested in the project's Contract Documents.
- .3 Assemble mock-ups in locations acceptable to DCC Representative, or where location is indicated in the technical specification Section.
- .4 Schedule mock-ups ready for DCC Representative's review and in orderly sequence, to avoid delays in Work.
 - .1 Failure to prepare mock-ups in ample time is not considered sufficient reason to request an extension of Contract Time.
- .5 If requested, DCC Representative will assist in preparing schedule fixing dates for preparation.
- .6 Construct mock-ups using materials, finishes, colours, and methods proposed for the completed Work. Mock-ups to demonstrate proposed workmanship and range of aesthetic appearance.
- .7 Where a mock-up represents or affects multiple specification Sections, coordinate activities of these Subcontractors to ensure mock-ups are complete.
- .8 Modify or replace mock-ups when unacceptable to DCC Representative.
- .9 Obtain DCC Representative 's acceptance of mock-ups installation before beginning to install those portions of the Work represented by the mock-up.
- .10 Maintain acceptable mock-ups in an undisturbed condition as a standard for judging the completed Work.
- .11 Mock-ups may remain as part of Work, unless indicated otherwise in a technical specification Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 Commissioning of Thermal and Moisture Protection
- .2 Section 08 08 00 Commissioning of Openings

1.2 INSPECTION

- .1 Allow DCC Representative access to Work. 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 will order 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 will pay cost of examination and replacement.

1.3 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.

1.4 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 orderly sequence to not cause delays 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.

1.5 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, difference in value between Work performed and that called for by Contract Documents will be deducted from Contract Price, amount of which will be determined by DCC Representative.

1.6 REPORTS

- .1 Submit inspection and test reports to DCC Representative in accordance with Section 01 33 00 Submittals Procedures.
- .2 Provide copies to subcontractor of work being inspected or tested.

1.7 TESTS

- .1 For tests related to Commissioning of thermal and moisture protection, and of openings, refer to Sections 07 08 00 - Commissioning of Thermal and Moisture Protection and 08 08 00 Commissioning of Openings.
- .2 Tests And Mix Designs
 - .1 Furnish test results and mix designs as requested.
 - .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by DCC Representative and may be authorized as recoverable.
- .3 Mill Tests
 - .1 Submit mill test certificates as required of specification Sections.

1.8 EQUIPMENT AND SYSTEMS

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

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. Refer to Section 01 35 43 - Environmental Protection.

1.4 WATER SUPPLY

- .1 DCC Representative will provide continuous supply of potable water for construction use.
- .2 Arrange for connection with DCC Representative and pay costs for installation, maintenance, and removal.
- .3 DCC Representative shall determine delivery points and quantitative limits. DCC Representative's written permission is required before any connection is made.
- .4 Provide, at no cost to DND, all equipment and temporary lines to bring the water service to project site.
- .5 The supply of temporary services by DND is subject to DND requirements and may be discontinued by the DND Representative at any time without notice and without acceptance of any liability for any damage or delay caused by such withdrawal of temporary services.

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.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation, and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.

- .4 Maintain temperatures of minimum 10°C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours, or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system after cessation of work process to ensure removal of harmful contaminants.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6 TEMPORARY POWER AND LIGHT

- .1 Temporary construction service will be the contractor's responsibility and is to be coordinated with Hydro One and ESA.
- .2 All fees and permits are the contractor's responsibility.
- .3 Size and maximum allowed amperage is limited by Hydro One's ability to supply power to the site.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .5 Existing electrical power and lighting systems and those 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 that have been used for more than 3 months.

1.7 FIRE PROTECTION

- .1 Refer to Section 01 35 35 - - DND Fire Safety Requirements.
- .2 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations, and bylaws.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA S269.2-16, Access Scaffolding for Construction Purposes.
 - .2 CAN/CSA Z321-96 (R2006), Signs and Symbols for the Workplace.

1.2 SUBMITTALS

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

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 that 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 CSA S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs.

1.5 HOISTING

- .1 Provide, operate and maintain hoists as 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 operators.

1.6 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.

1.7 SANITARY FACILITIES

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

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

1.8 CONSTRUCTION SIGNAGE

- .1 Signs and notices for safety and instruction in both official languages; graphic symbols to CAN/CSA Z321.
- .2 Maintain approved signs and notices in good condition for duration of project and dispose off site on completion of project, or earlier if directed by DCC Representative.

1.9 TEMPORARY STABILIZED CONSTRUCTION ENTRANCE

- .1 Establish a clean gravel pad at each construction entrance of sufficient length and depth to trap clay and excavation debris.
- .2 Clean gravel on a regular basis to prevent build-up of clay and prevent sediment from being tracked onto roadway.
- .3 Clean dirt or mud tracked onto paved or surfaced roadways.

1.10 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by DCC Representative.
- .2 Provide measures for protection, control, 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 is responsible for repair of damage to roads caused by construction operations.

1.11 TEMPORARY COMMUNICATION FACILITIES

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

END OF SECTION

Part 1 General

1.1 PROTECTION OF PUBLIC TRAFFIC

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 When working on travelled way:
 - .1 Place equipment in position to minimize interference and hazard to travelling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .3 Close lanes of road only after receipt of written approval from DCC Representative.
 - .1 Before re-routing traffic erect suitable signs and devices to Ontario Traffic Manual, Book 7: Temporary Conditions.
- .4 Keep travelled way graded, free from potholes and of sufficient width for required number of lanes of traffic.
 - .1 Provide 7 m wide minimum temporary roadway for traffic in two-way sections through Work and on detours.
 - .2 Provide 5 m wide minimum temporary roadway for traffic in one-way sections through Work and on detours.
- .5 Provide detours or temporary roads as indicated, and as approved by DCC Representative to facilitate passage of traffic around restricted construction area:
- .6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, except where other means of road access exist that meet approval of DCC Representative.

1.2 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response, as approved on traffic control plan by DCC Representative.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to Ontario Traffic Manual, Book 7: Temporary Conditions.
- .3 Place signs and other devices in locations recommended in Ontario Traffic Manual, Book 7: Temporary Conditions.

- .4 Meet with DCC Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of DCC Representative.
- .5 Continually maintain traffic control devices in use:
 - .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Remove or cover signs which do not apply to conditions existing from day to day.

1.3 CONTROL OF PUBLIC TRAFFIC

- .1 Provide competent flag personnel, trained in accordance with, and properly equipped to Ontario Traffic Manual, Book 7: Temporary Conditions for situations as follows:
 - .1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.
 - .2 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .3 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .4 For emergency protection when other traffic control devices are not readily available.
 - .5 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
 - .6 Delays to public traffic due to contractor's operators: 15 minutes maximum.
- .2 Where roadway, carrying two-way traffic, is restricted to one lane, for 24 hours each day, provide portable traffic signal system.
 - .1 Adjust, as necessary, and regularly maintain system during period of restriction.
 - .2 Ensure signal system meets requirements of Ontario Traffic Manual, Book 7: Temporary Conditions.

1.4 OPERATIONAL REQUIREMENTS

- .1 Maintain existing conditions for traffic throughout period of contract except that, when required for construction under contract and when measures have been taken as specified and approved by DCC Representative to protect and control public traffic.
- .2 Provide plan for traffic management to DCC Representative for review when existing conditions for traffic cannot be maintained due to construction

requirements. Plan must be approved by DCC Representative prior to traffic disruption.

- .3 Limit access to traffic for a maximum delay of 15 minutes without written approval and a traffic control plan in place.

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 INSTALLATION AND REMOVAL

- .1 Provide temporary controls to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.2 SITE ENCLOSURE

- .1 Erect temporary site enclosure using steel wire mesh temporary fencing.
 - .1 Minimum height: 1800 mm.
 - .2 Mesh size: 50 x 100 mm, 3.5 mm thickness.
 - .3 Frame: 25 x 25 mm x 1.2 mm thickness.
 - .4 Provide feet blocks and bracing as required for stable installation.
 - .5 Erect fence at perimeter of site to fully enclose the site.
 - .6 Construct fence to deter entry by unauthorized persons.
 - .7 Maintain fence in good repair.
- .2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, and open edges of floors and roofs.
- .2 Provide as required by governing authorities.
- .3 Guardrail or similar system shall remain in place for the balance of the project including commissioning and demonstration / training as applicable.

1.4 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs until they are permanently enclosed.
- .2 Erect enclosures to allow access for the installation of materials and to allow for work inside enclosure.
- .3 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .4 Design enclosures to withstand wind pressure and snow loading.
- .5 Ensure that upon final construction, and during construction, the work is executed to prevent the entry of water, snow, and air into the interior of the building and to accept the responsibility to correct any deficient work. Bring to the attention of the DCC Representative, prior to construction, details that may compromise weather tightness.

- .6 Provide weather enclosures or other means as necessary to protect foundation excavations to maintain soil bearing capacity.

1.5 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.
- .3 Coordinate location and security measures with DCC Representative on Site.

1.6 ACCESS TO SITE

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

1.7 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, and lanterns as required to perform Work and protect public.

1.8 FIRE ROUTES

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

1.9 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.

1.10 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 locations and installation schedule with DCC Representative, minimum three 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 REFERENCE STANDARDS

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality 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 disputes 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 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for 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.

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 will 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 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 co-operation 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 Refer to Section 01 73 00 - Execution.
- .2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .3 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 Prevent overloading of parts of building. Do not cut, drill or sleeve 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 building occupants.
- .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

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit to the DCC representative copies of the following documents, including updates issued:
 - .1 Health and Safety Policy & 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 The Ontario Workplace Safety & Insurance Board (WSIB).
 - .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 WSIB worker's compensation 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 clearance certificate from the WSIB 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 Delineate and isolate the work areas from adjacent and surrounding areas 1.8 metre rigid fence to maintain control of all work area access points so that access to the project site work areas is restricted to authorized (construction) personnel only. The public way site delineation requirements shall meet or exceed the prescribed requirements specified in the Ontario Occupational Health and Safety Act & Regulations, specifically Section 64-65 (O. Reg. 213/91).
- .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 For the purpose of this contract, the following are activities that will be required to be performed on the work site by DND forces and other Contractor(s). Control of the work site access and activities remain the responsibility of the Contractor as detailed within this specification section.
 - .1 Real Property Operations Detachment Kingston, throughout the project where required (for example, base issued permits, service shut-downs, locates, etc.)
- .5 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 and is not to be used as advertising but for the specific use as related to site safety and key contact information.
 - .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.:

- .6 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 Ontario Ministry of Labour 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, for example CFB Kingston Hot Work Permit.
- .2 Post all permits, licenses and compliance certificates on work site and provide copies to the DCC representative.

1.7 PROJECT/SITE CONDITIONS

- .1 DND has provided the following list of known hazardous substances and/or hazardous conditions at the work site which should be considered for inclusion on the Constructor's hazard assessment, as health or environmental hazards and shall be properly managed should they be encountered as part of the work:
 - .1 General construction type hazards;
 - .2 Public safety hazards;
 - .3 Excavation and trenching hazards;
 - .4 Power mobile equipment hazards;
 - .5 Working at heights hazards;
 - .6 Electrical & Mechanical hazards;
 - .7 Confined Space Entry hazards – confined spaces shall be entered with precautions that meet or exceed the prescribed requirements of ON OHSA O. Reg. 632/05;
 - .8 Contractors are required to be aware of the known hazardous substances and/or hazardous conditions and are to include in their tender price all work associated in working with, in and around the hazards.
- .2 The above lists shall not be construed as being complete and inclusive of all safety and health hazards encountered as a result of Contractor's operations during the course of work. Include above items into the hazard assessment program specified herein.

1.8 MEETINGS

- .1 Prior to commencement of work attend a pre-commencement meeting conducted by the DCC representative. Ensure minimum attendance by contractor's site superintendent. The 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 the DCC representative upon request.

1.9 HEALTH AND SAFETY POLICY & PROGRAM

- .1 Contractors are required under the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act to have in place a Health and Safety policy and program to support the policy. Compliance requirements for the content, detail and implementation of the policy and program resides with the Ontario Ministry of Labour. For the purpose of this contract the Health and Safety policy & program shall include, a signed / dated (current) safety policy statement and a program to support the policy (safe work procedures & practices, etc.) a site-specific hazard assessment that acknowledges, assesses and addresses the hazardous substances and/or hazardous conditions known and identified in paragraph 1.7 above, and on-going hazard assessment(s) shall be performed during the progress of work identifying and documenting new or known & potential health risks and safety hazards not previously known and identified.
- .2 Provide a copy of the Health and Safety Policy & 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 the Ontario Occupational Safety and Health Act, and the Regulations made pursuant to the Act.

- .2 For the purpose of this contract immediately notify DCC representative, investigate and provide a report within 24 hours 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 DCC's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

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

1.1 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.

1.2 SURVEY REQUIREMENTS

- .1 Establish permanent benchmarks on site, referenced to established benchmarks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate, and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement.
- .4 Stake slopes.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

1.3 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 cut-off points as directed by DCC Representative.

1.4 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.

1.5 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles, and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.6 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 with Contract Documents.

1.7 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.
- .2 After prompt investigation, should DCC Representative determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 84 00 - Firestopping

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

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 are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching, including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ experienced installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 Provide firestopping in accordance with Section 07 84 00 - Firestopping to maintain integrity of fire separations, including:
 - .1 Protecting penetrations at fire-resistance rated wall, ceiling or floor construction.
 - .2 Using construction joint fire stops and building perimeter fire stops to protect gaps at fire separations and between fire separations and other construction assemblies.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 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 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by DCC Representative. Do not burn waste materials on site.
- .3 Dispose of waste materials and debris off site.
- .4 Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Provide on-site containers for collection of waste materials and debris.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .3 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.

- .4 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, ceilings, and floors.
- .5 Clean lighting reflectors, lenses, and other lighting surfaces.
- .6 Vacuum clean and dust building interiors, behind grilles, louvres, and screens.
- .7 Clean ducts and vents.
- .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 gutters, areaways, and sunken wells.
- .13 Sweep and wash clean paved areas.
- .14 Clean equipment and fixtures to 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.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor's commitment to reduce and divert waste materials from landfill and includes the following:
 - .1 Preparation of a Draft Construction Waste Management Plan that will be used to track the success of the Construction Waste Management Plan against actual waste diversion from landfill.
 - .2 Preparation of a Construction Waste Management Plan that provides guidance on a logical progression of tasks and procedures to be followed in a pollution prevention program to reduce or eliminate the generation of waste, the loss of natural resources, and process emissions through source reduction, reuse, recycling, and reclamation.
 - .3 Preparation of monthly progress reports indicating cumulative totals representing progress towards achieving diversion and reduction goals of waste materials away from landfill and identifying any special programs, landfill options or alternatives to landfill used during construction.
 - .4 Preparation of a Construction Waste Management Report containing detailed information indicating total waste produced by the project, types of waste material and quantity of each material, and total waste diverted and diversion rates indicated as a percentage of the total waste produced.

1.2 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, re-modeling, repair and demolition operations.
- .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 (VOCs): 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, VOCs 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.
- .18 Construction Waste Management Plan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.3 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 Work of the Contract attended by the Contractor, affected Subcontractors and DCC Representative to discuss Contractor's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.4 SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Draft Construction Waste Management Plan (Draft CWM Plan): Submit to DCC Representative a preliminary analysis of anticipated site generated waste by listing a minimum of five (5) construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies; DCC Representative will provide commentary before development of Contractor's Construction Waste Management Plan.
 - .2 Construction Waste Management Plan (CWM Plan): Submit a CWM Plan for this project prior to any waste removal from site and that includes the following information:
 - .1 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the Draft CWM Plan; materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as contributing to waste diversion and will be included as a component of the total waste generated for the site.
 - .2 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials and incorporate into CWM Plan.
 - .3 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled, or composted during the course of the project, and the proposed local market for each material.
 - .4 Landfill Materials: Identify materials that cannot be recycled, reused or composted and provide explanation or justification;

energy will be considered as a viable alternative diversion strategy for these materials where facilities exist.

- .5 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the project.
- .6 Materials Handling Procedures: A description of the means by which recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
- .7 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

1.5 PROJECT CLOSEOUT SUBMISSIONS

- .1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 – Closeout Submittals as follows:
 - .1 Construction Waste Management Report (CWM Report): Submit a CWM Report for this project in a format acceptable to submittal requirements and that includes the following information:
 - .1 Accounting: Submit information indicating total waste produced by the project.
 - .2 Composition: Submit information indicating types of waste material and quantity of each material.
 - .3 Diversion Rate: Submit information indicating total waste diverted from landfill as a percentage of the total waste produced by the project.
 - .4 Transportation Documentation: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.
 - .5 Alternative Daily Cover (ADC): Submit quantities of material that were used as ADC at landfill sites, and that form a part of the total waste generated by the project.
 - .6 Multiple Waste Hauling: Compile all information into a single CWM Report where multiple waste hauling and diversion strategies were used for the project.
 - .7 Photographs: Submit photographs of waste diversion facilities documenting location and signage describing usage of waste separation containers.

1.6 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.
- .2 Certifications: Provide proof of the following during the course of the Work:
 - .1 Compliance Certification: Provide proof that recycling center is third party verified and is listed as a Certified Facility through the registration and certification requirements of the Recycling Certification Institute.

1.7 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

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, the DCC Representative and other site personnel as required to maintain CWM Plan.
- .3 Instruction: Provide on site instruction to Subcontractors of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the project 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.
- .5 Progressive Documentation: Submit a monthly summary of waste generated by the project to ensure that waste diversion goals are on track with project requirements:
 - .1 Monthly waste summary to contain the following information:
 - .1 The amount in tonnes or m³ and location of material landfilled,
 - .2 The amount in tonnes or m³ and location of materials diverted from landfill, and
 - .3 Indication of progress based on total waste generated by the project with materials diverted from landfill as a percentage.

3.2 SUBCONTRACTOR'S RESPONSIBILITY

- .1 Subcontractors shall cooperate fully with the Contractor to implement the CWM Plan.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection:
 - .1 Contractor: Conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .2 Notify DCC Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .3 Request DCC Representative inspection.
 - .2 DCC Representative Inspection:
 - .1 DCC Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: Submit written certificates, in English, indicating that tasks have been performed as follows:
 - .1 Work: Completed and inspected for compliance with Contract Documents.
 - .2 Defects: Corrected and deficiencies completed.
 - .3 Equipment and systems: Tested, adjusted, balanced, and fully operational.
 - .4 Certificates required by Canadian Forces Fire Marshal (CFFM), Utility companies: Submitted.
 - .5 Operation of systems: Demonstrated to designated personnel.
 - .6 Work: Complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by DCC Representative, and Contractor.
 - .2 When Work incomplete according to DCC Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

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

- .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Contractor's Representative and DCC Representative, in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 DCC Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide As-Built documents, surveys, warranties, and other required documentation in electronic format on a thumb drive, as well as hard copies.
- .3 Provide spare parts, maintenance materials, and special tools of same quality and manufacture as products provided in Work.
- .4 Within one week following Substantial Performance of the Work, submit final copies of Operating and Maintenance (O&M) manual to DCC Representative.
 - .1 Media:
 - .1 Printed copy.
 - .2 PDF format.
 - .2 Language: English.
 - .3 Arrange content by systems, under Section numbers and sequence of Table of Contents.
 - .4 Provide tab for each separate product and system.
 - .5 Text: manufacturer's data.

1.3 CONTENTS - PROJECT AS-BUILT DOCUMENTS

- .1 Project information:
 - .1 Title of project.
 - .2 Date of submission; names.
 - .3 Addresses, and telephone numbers of DCC Representative, Consultants and Contractor, with names of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
 - .5 Table of Contents.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: Mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Text: as required to supplement product data.

1.4 AS-BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for DCC Representative, one copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store as-built documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label as-built documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "AS-BUILT" in neat, large, printed letters.
- .4 Maintain as-built documents in clean, dry, and legible condition.
 - .1 Do not use as-built documents for construction purposes.

- .5 Keep as-built documents and samples available for inspection by DCC Representative.

1.5 RECORDING INFORMATION ON PROJECT AS-BUILT DOCUMENTS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 Referenced Standards to related shop drawings and modifications.
 - .8 Site surface elevations. Shots at each location where proposed grade exists on grading plan.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.6 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.7 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 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.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 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 co-ordination 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.
- .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.
- .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 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to DCC Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to DCC Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.

- .1 Submit inventory listing to DCC Representative.
- .2 Include approved listings in Maintenance Manual.

1.10 DELIVERY, STORAGE AND HANDLING

- .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 for review by DCC Representative.

1.11 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to DCC Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that DCC Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to DCC Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.

- .7 Except for items put into use with DCC Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .3 Procedure and status of tagging of equipment covered by extended warranties.
 - .4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.

- .1 Failure to respond will be cause for the DCC Representative to proceed with action against Contractor.

1.12 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by DCC Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Operator Training will be provided and coordinated by the Contractor and overseen by the DCC Representative and CxA to help ensure that the Operators are adequately prepared to operate and maintain the facility at turnover.

1.2 TRAINEES

- .1 Personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction.

1.3 INSTRUCTORS

- .1 The Contractor is responsible for training of O & M staff.
- .2 Contractor and certified factory-trained manufacturers' personnel to provide instruction.

1.4 TRAINING OBJECTIVES

- .1 Training to be detailed and of sufficient duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis, and trouble-shooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

- .1 Contractor to be responsible for content and quality.
- .2 Submit a training plan and schedule to the DCC Representative and CxA for review. Include the required number of hours required for training on each system and/or piece of equipment.
- .3 Training plan will address the following topics (at a minimum)
 - .1 Overview of all building systems.
 - .2 Use of Operations and Maintenance (O&M) Manuals

- .3 Startup and Shutdown
- .4 Unoccupied operations
- .5 Seasonal changeover
- .6 Manual operations
- .7 Alarms
- .8 System interactions
- .9 Energy conservation optimizations
- .10 Health and safety
- .11 Special maintenance or replacement
- .12 Occupant interaction
- .13 Systems response to operating conditions
- .4 Supplement training materials with:
 - .1 Multimedia presentations.
 - .2 Manufacturer's training videos.
 - .3 Equipment models.
- .5 Video record all training sessions and provide electronic copies of all training materials to permit for future O&M staff training to same degree of detail.
- .6 Contractor shall document training exercises with attendance sheets and surveys after training is completed. Submit to CxA for inclusion in the Cx manual.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Training shall occur after functional testing and labeling are complete.
- .3 Deliver training during regular working hours.
- .4 Complete delivery of training prior to acceptance of facility.

1.7 ACCEPTANCE

- .1 At the end of training, obtain and submit to Commissioning Authority, signed statement from the DCC Representative stating they understand system and equipment installation, operation, and maintenance requirements.
- .2 Submit to Cx Authority complete record of instructions as part of maintenance instructions and data book given.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements of system functional performance testing, equipment, sub-systems, systems, and integrated systems.
- .2 Related Sections:
 - .1 Division 01 45 00 Quality Controls
 - .2 Division 01 35 43 Environmental Procedures
 - .3 Division 01 41 00 Regulatory Requirements
 - .4 Division 21 Fire Suppression
 - .5 Division 22 Plumbing
 - .6 Division 23 Heating, Ventilation and Air Conditioning
 - .7 Division 26 Electrical
 - .8 Division 27 Communications
 - .9 Division 28 Electronic and Security
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider
 - .2 BMM - Building Management Manual
 - .3 CPS - Commissioning Plan Schedule
 - .4 EMCS - Energy Monitoring and Control Systems
 - .5 ESR - Equipment Start-Up and Acceptance Report
 - .6 O&M - Operation and Maintenance
 - .7 SFPTF - System Functional Performance Test Form
 - .8 SVF - System Verification Form
 - .9 TAB - Testing, Adjusting and Balancing
 - .10 DCC – Defence Construction Canada
 - .11 CFHA – Canadian Forces Housing Authority

1.2 GENERAL

- .1 Commissioning is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Commissioning is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed documented and approved.
 - .2 Contractor shall organize all Static Testing and Documentation, Manufacture and Trade Start up Reports, Installation Check Sheets completion. Ensuring
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Contractor's Verification and integrated testing has been completed before requesting the final commissioning with DCC.

- .3 DCC Representative shall be available to chair Commissioning Meetings and complete minutes, attend all static testing, start-up, and final commissioning. DCC will Coordinate the Training with CFHA and/or DND at the request of the Contractor and the schedule.
- .4 Objectives:
 - .1 To bring architectural, life safety systems, mechanical and electrical systems from a state of static completion to a state of dynamic operation.
 - .2 To verify conformance to contract requirements.
 - .3 To verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .4 To ensure that the completed facility meets user stated requirements and effectively train O&M staff; and
 - .5 To ensure appropriate documentation is compiled into the BMM.
 - .6 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to interact with each other as intended in accordance with Contract Documents and design criteria.
 - .7 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .5 Design Criteria:
 - .1 As per client's requirements or determined by designer.
 - .2 To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 For commissioning it is the responsibility of the Contractor to organize and bare all cost for the commissioning of all building systems and documentation. DCC shall witness and sign all static testing and integrated testing. DCC will invite other stakeholders.
- .2 Commissioning to be a line item of Contractor's cost breakdown.
- .3 Commissioning activities supplement field quality and testing procedures described in relevant technical sections.
- .4 Prior to Substantial Completion of commissioned systems, the contractor shall:
 - .1 Submit commissioning documentation to the satisfaction of DCC.
 - .2 Commission all equipment, components, and systems have been commissioned as per design intent.
 - .3 Final Air or Hydronic Balance reports have been submitted and reviewed; and accepted by DCC, Design Consultant.
 - .4 ASBUILT Drawings have been submitted and reviewed and accepted.

- .5 Submittals of final ESA Certifications, TSSA Certifications and any other systems certifications required under the systems installation in the contract.
- .6 O&M training has been completed.
- .7 Seasonal Commissioning to be completed under design conditions contractor to submit return dates for completion.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during commissioning, correct deficiencies, re-verify equipment and components within the un-functional system, including related systems as deemed required by DCC to ensure effective performance.
- .2 The costs for corrective work, additional tests and inspections required to determine the acceptability and proper performance of such items to be borne at the contractor cost.

1.5 PRE-COMMISSIONING REVIEW

- .1 During Construction:
 - .1 The contractor to coordinate provision, location, and installation of provisions for commissioning with DCC.
- .2 Before Start of Commissioning:
 - .1 Have completed Commissioning Plan to date.
 - .2 Ensure installation of related components, equipment, systems, and sub-systems is complete.
 - .3 Fully understand commissioning requirements and procedures.
 - .4 Have commissioning documentation available on site for DCC review.
 - .5 Submit complete start-up documentation to DCC.
 - .6 Have commissioning schedules up to date.
 - .7 Ensure systems have been cleaned thoroughly.
 - .8 Complete TAB procedures on systems and submit TAB reports to DCC for review and approval.
 - .9 Ensure "As-Built" system schematics are available for review by DCC, Design Consultant or CFHA Design Engineers
- .3 Inform DCC in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to DCC before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

- .1 Submittals: in accordance with Division 1

Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Commissioning Provider can be an employee with commissioning experience
 - .2 Draft Commissioning Plan
 - .3 Preliminary commissioning schedule
- .2 Request in writing to DCC for changes to submittals and obtain written approval at least 8 weeks prior to start of commissioning.
- .3 Submit proposed commissioning procedures to DCC where not specified and obtain written approval at least 8 weeks prior to start of commissioning.

1.8 COMMISSIONING DOCUMENTATION

- .1 The Mechanical and Electrical Contractor can submit their own company forms if available, or DCC can supply appropriate forms after contract award.
- .2 DCC to review and approve commissioning documentation.
- .3 Provide completed and approved commissioning documentation to DCC.

1.9 COMMISSIONING PLAN SCHEDULE

- .1 The Contractor shall prepare and coordinate the commissioning schedule with the construction schedule, commissioning schedule prepared and submitted by the contractor.
- .2 The CPS will be updated every month. Copies of this schedule and updates will be distributed to DCC.

1.10 COMMISSIONING MEETINGS

- .1 Meetings shall be regularly scheduled in the Construction Meetings or possible separate commissioning meeting depending on project size, discuss, and review commissioning activities. Continue commissioning meetings on regular basis until commissioning deliverables have been addressed. DCC, Contractor, Sub-Contractors, will be required to attend meetings.
 - .2 Meetings shall take place until work has been completed.
 - .3 The construction schedule, commissioning plan schedule, and the commissioning plan shall be reviewed and updated as required. Upcoming tests and equipment start-ups shall be reviewed and completed test results will be evaluated.
 - .4 DCC will take minutes of meetings and distribute copies to all team members within one week of a meeting.
-

- .5 Contractor's Commissioning Provider shall be present at tests performed and documented by sub-trades, suppliers, and equipment manufacturers. DCC to be notified on dates and times of the start-ups.

1.11 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing:
 - .1 Equipment manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by DCC.
 - .3 Arrange for DCC to witness tests on site Factory Test if required in the contract documents; and
 - .4 Obtain written approval of test results and documentation from DCC before delivery to site.
 - .2 Obtain manufacturers installation, start-up, and operations instructions prior to start-up of components, equipment and systems and review with DCC.
 - .3 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
 - .4 Integrity of warranties:
 - .1 Use manufacturers' trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
 - .3 Manufactures Start-up documentation to be completed and submitted to DCC

1.12 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing, and commissioning.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of System Verification Forms (SVF); and
 - .2 Visual inspection of quality of installation.
 - .3 Refrigeration Equipment is required to be leak checked on arrival to site as per specification section Halocarbon Management Section 01 35 43.
 - .2 Equipment Start-Up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System Functional Performance Testing: include repetition of tests after correcting deficiencies.

- .5 Post-substantial performance verification: to include seasonal commissioning.
- .3 Correct deficiencies and obtain approval from DCC after distinct phases have been completed and before commencing next phase.
- .4 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by DCC. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by DCC.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by DCC.
 - .3 If evaluation report concludes that major damage has occurred, shall reject equipment. DCC
 - .1 Rejected equipment to be removed from site and replaced with new.
 - .2 Subject new equipment or systems to specified start-up procedures.

1.13 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to DCC for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports; and
 - .5 Step-by-step description of complete start-up procedures, to permit to repeat start-up at any time.

1.14 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer
- .2 Equipment that will be delivered and on site for a length of time before installation and start-up the contractor must follow the Manufactures long term storage process and identify to DCC.
- .3 After completion of the dynamic commissioning, operate and maintain systems until issuance substantial completion certificate. If applicable, systems with BAS Control will be required to be Alarm free and all final adjustments have been complete. Bas Control trending to be carried out based on the specification requirements. Carry out Commissioning:

- .1 Under actual operating conditions, over entire operating range, in all modes; (Once building construction is complete and clean)
- .2 On independent systems and interacting systems.
- .4 Commissioning procedures to be repeatable and reported results are to be verifiable.
- .5 Follow equipment manufacturer's operating instructions.
- .6 If applicable, EMCS trending to be available as supporting documentation for performance verification.

1.15 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of Authority Having Jurisdiction, arrange for authority to witness procedures to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of Authority Having Jurisdiction, ESA, TSSA, Life Safety Systems Verification Reports (DCC/DND Fire Service) or any other certifications required in the contract documents.
- .3 Provide copies to DCC the day of test and with commissioning report.

1.16 EXTENT OF VERIFICATION

- .1 Provide manpower and instrumentation to verify up to 100 % of reported results control point to point and sequence of operation.
- .2 Balancing verification of 30 % of testing readings by DCC on site locations of testing verification will be decided at time of site verification.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment and instrumentation.

1.17 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and commissioning to satisfaction of DCC.

1.18 COMPLETION OF COMMISSIONING

- .1 Upon completion of commissioning leave systems in normal operating mode.
 - .2 Except for warranty and seasonal verification activities specified in commissioning specifications, complete commissioning prior to issuance of substantial Completion.
-

- .3 Commissioning to be considered complete when contract commissioning deliverables have been submitted and accepted by DCC.
- .4 DCC Site Commissioning Coordinator will complete a final commissioning report identifying the systems that have been commissioned what the process was and the attendees. The Final report will also identify the Seasonal Commissioning required with a return date agreed with the construction team.

1.19 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 Contractor to submit all Static Testing, Manufactures Start-up Reports, Contractor's installation Check Sheets all Technical Authority Inspection Documents and certifications.
- .2 Documentation to be in a tab form binder based on the specification sections.
- .3 Letter confirming the Contractor and Subtrades will return for seasonal equipment complete with the system and the date of return.
- .4 DCC to identify in writing any specification requirements for inspections over the 1-year warranty period. The document to identify the date of the return visit for the inspection and the testing procedure required. DCC Site personal will organize the required access to the building based on the agreed dates. Example contractor to return for systems operation and calibration.

TRAINING

- .5 Contractor is to ensure the training dates are part of the commissioning schedule and the Contractor will be responsible to send out training invites out to DCC, 2 weeks in advance.
- .6 To be video taped for all Major Mechanical, Electrical and Communication System as per design requirements
- .7 Major Equipment Training to be on site when systems have been fully commissioned and operational.

Part 2 Commissioning Sample forms

- 2.1 DCC can supply electronic copies of Commissioning forms at the request of the Contractor following contract award.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 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 CSA O121-17, Douglas Fir Plywood
 - .3 CSA S269.1-16, Falsework and formwork
 - .4 CAN/CSA S269.3-M92, Concrete Formwork
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS SDS - Safety Data Sheets.
- .3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 Indicate sequence of erection and removal of formwork/falsework as directed by DCC Representative.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Place materials defined as hazardous or toxic in designated containers.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121.

- .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .3 Rigid insulation board as shown: refer to 07 21 13 - Board Insulation.
- .2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.
- .3 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .4 Void form: Honeycomb-type biodegradable plastic wrapped cardboard, 150 mm thick, treated to provide sufficient structural support for poured concrete until concrete cures.
- .5 Form release agent: non-toxic, low VOC.
- .6 Form stripping agent: colourless mineral oil, non-toxic, free of kerosene, with viscosity between 70 and 110s Saybolt Universal 15 to 24 mm²/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .7 Falsework materials: to CSA-S269.1.
- .8 Sealant: to Section 07 92 00 - Joint Sealants.

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's 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/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Construct forms for architectural concrete, and place ties as indicated.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .13 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .14 Line forms for following surfaces:
 - .1 Outer face of outside, girders, beams, and vertical edge of bridge sidewalk slab.
 - .2 Soffit of girders and underside of bridge decks if exposed.
 - .3 Exposed faces of abutments, wingwalls, piers and pylons: do not stagger joints of form lining material and align joints to obtain uniform pattern.
 - .4 Secure lining taut to formwork to prevent folds.
 - .5 Pull down lining over edges of formwork panels.
 - .6 Ensure lining is new and not reused material.
 - .7 Ensure lining is dry and free of oil when concrete is poured.
 - .8 Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - .9 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
 - .10 Cost of textile lining is included in price of concrete for corresponding portion of Work.
- .15 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 Walls and columns; concrete curing temperatures of:
 - .1 21C to 35C = 2 days
 - .2 16C to 21C = 3 days
 - .3 10C to 16C = 4 days
 - .2 Beam soffits, slabs, decks, and other structural members; concrete curing temperatures of:
 - .1 21C to 35C = 14 days

- .2 16C to to 21C = 17 days
- .3 10C to 16C = 21 days
- .2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction at not more than 3000 mm apart.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 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 G30.5-M1983(R1998), Welded Steel Wire Fabric for Concrete Reinforcement
 - .4 CAN/CSA G30.18-09, Carbon steel bars for concrete reinforcement
 - .5 CAN/CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
 - .6 CSA W186:21, Welding of reinforcing bars in reinforced concrete construction
- .2 Reinforcing Steel Institute of Canada (RSIC):
 - .1 RSIC-2020, Manual of Standard Practice

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
 - .1 Submit drawings which indicate:
 - .1 Placing of reinforcement.
 - .2 Bar bending details.
 - .3 Lists.
 - .4 Quantities of reinforcement.
 - .5 Sizes, spacings, locations of reinforcement and mechanical splices if approved by DCC Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .6 Indicate sizes, spacings, and locations of chairs, spacers and hangers.
 - .2 Detail lap lengths and bar development lengths to CAN/CSA A23.3.

1.3 QUALITY CONTROL

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

- .1 Mill Test Report: upon request, provide DCC Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request, submit in writing to DCC Representative proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirement and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .4 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 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 Welded steel wire fabric: To CSA G30.5.
 - .1 Provide in flat sheets only.
- .5 Chairs, bolsters, bar supports, spacers: To CSA-A23.1/A23.2.
- .6 Mechanical splices: subject to approval of DCC Representative.
- .7 Plain round bars: To CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain DCC Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of DCC Representative, weld reinforcement in accordance with CSA W186.

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 4 weeks prior to beginning reinforcing work.
- .2 Upon request, inform DCC Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

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

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain DCC Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Reference Standards:

.1 ASTM International

- .1 ASTM C260/C260M-10a, 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 D570-22. Standard Test Method for Water Absorption of Plastics**
- .5 ASTM D695-23, Standard Test Method for Compressive Properties of Rigid Plastics**
- .6 ASTM D1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).**

.2 Canadian General Standards Board (CGSB):

- .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction**

.2 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**
- .1 CSA-A266.5-M1981, Guidelines for the Use of Superplasticizing Admixtures in Concrete**
- .2 CSA-A266.6-M85, Admixtures for Concrete**
- .3 CSA A283:19, Qualification code for concrete testing laboratories**
- .4 CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)**
- .5 CSA B651-18, Accessible design for the built environment**

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

- .1 Safety Data Sheets (SDS)**

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: in accordance with Section 01 32 16.19 - Construction Progress Schedules - Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning concrete works.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit concrete mix designs of any mix designed by the Contractor to the DCC Representative for review 14 days prior to placement. Concrete mix design submittals shall include the mass in kilograms of fine aggregate, coarse aggregate, cement, fly ash, silica fume and water in each cubic metre of concrete. Concrete mix design submittals shall specify the properties of the concrete.
- .3 Provide testing and inspection results reports for review by DCC Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .4 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.
- .5 Concrete hauling time: provide, for review by DCC Representative, deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .6 Aggregates:
 - .1 At least four weeks prior to commencing work of this section, inform the DCC Representative of proposed source of aggregates.
 - .2 Submit a letter of assurance that the proposed aggregate source will not produce concrete that will be compromised by deleterious effects from alkali-aggregate reaction.
- .7 Submit manufacturer's datasheets and printed instructions for joint sealant and primer proposed for use in the Work.
- .8 Submit two copies of WHMIS Safety Data Sheets (SDS).
- .9 Sustainable Design Submittals: Information demonstrating sustainability characteristics specified in this Section.
 - .1 Submit information regarding:
 - .1 Environmental product declarations (EPDs)
 - .2 Recycled content
 - .3 Regional materials
 - .4 VOC and chemical emissions
 - .2 EPD: Identify these impact categories for each product:
 - .1 Global warming potential (GWP): Submit GWP information in the form of kg CO₂ eq.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Perform all concrete Work in accordance with the requirements of CAN/ CSA A23.1.
- .3 Provide DCC Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .4 Concrete testing shall be performed by the Contractor, and results submitted to the DCC Representative.
- .5 Submit test results based on trial mixes showing that concrete mix designs will produce concrete meeting the requirements of this section and that strength will comply with CAN/ CSA-A23.1.
- .6 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by DCC Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
- .7 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.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from DCC Representative, laboratory representative, and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by DCC Representative.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Alternative 2 - Prescription: 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 Reduce greenhouse gas (GHG) emissions from ready-mix concrete by minimum 30% less than those calculated using the global warming potentials (GWPs) of the baseline mix in the regional industry average EPD.
- .3 Provide SCMs and products that contribute to a 30% reduction in the GWP against the listed GWP identified in the regional industry average EPD and a reduction in the environmental impact categories as measured through a cradle-to-gate scope.

2.3 MATERIALS

- .1 Portland Cement: to CSA A3001.
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.
- .4 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494. DCC Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - .3 Superplasticizing admixtures: to CSA-A266.5, CSA-A266.6.
- .5 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
 - .1 Compressive strength: 35 MPa at 28 days.
 - .2 Net shrinkage at 28 days: maximum 0.10 %.
- .6 Curing compound: to CSA A23.1/A23.2, ASTM C309, white, water-based, and compatible with applied finishes.
- .7 Waterstops: hydrophilic swellable joint sealant.
- .8 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
- .9 Weep hole tubes: plastic.
- .10 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.

- .11 Dampproof membrane: refer to Section 07 13 52 - Modified Bituminous Sheet Waterproofing
- .12 Polyethylene film: 0.254 mm thickness to CAN/CGSB-51.34.

2.4 MIXES

- .1 Alternative 2 - Prescriptive Method for specifying concrete: concrete mix to CSA A23.1.
 - .1 Ensure materials used in concrete mix have been submitted for testing and meet requirements of CSA A23.1.
 - .2 Co-ordinate construction methods to suit DCC Representative concrete mix proportions and parameters.
 - .3 Identify and report immediately to DCC Representative when concrete mix design and parameters pose anticipated problems or deficiencies related to construction.
 - .4 Refer to Structural Drawings for concrete mix design requirements.

2.5 ACCESSORIES

- .1 Detectable Warning Tiles: Cast-in-Place wet-set, polyolefin, in-line truncated dome surface. Salt and chemical resistant.
 - .1 Domes, truncated: spaced in square grid according to CSA B651.
 - .1 Base diameter: min 23 mm (0.9 inch).
 - .2 Top diameter min 50% of base diameter.
 - .3 Height: 4 to 5 mm (0.2 inch).
 - .2 Slip Resistance: Dry, 1.28. Wet, 1.23.
 - .3 Water Absorption: To ASTM D570, 0.04%.
 - .4 Compressive Properties: ASTM D695, 76500 Kpa (11,100 psi).
 - .5 Colour: as selected by DCC Representative from manufacturer's standard range.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain DCC Representative's written approval before placing concrete.
 - .1 Provide 72 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Prior to placing concrete, ensure that all reinforcing and other items to be embedded in concrete are in place, properly oriented, located, and secured. Verify that concrete may be placed to the lines and elevations shown on the Drawings with all required clearances and cover for reinforcement. Ensure that forms are clean and absolutely all debris has been removed.

- .4 Obtain the DCC Representative's approval before placing concrete. Provide 48 hours' notice prior to placing of concrete.
- .5 Prior to placing concrete, obtain the DCC Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .7 Pumping of concrete is permitted only after approval of equipment and mix.
- .8 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .9 Prior to placing of concrete obtain DCC Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .10 Protect previous Work from staining.
- .11 Clean and remove stains prior to application for concrete finishes.
- .12 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .13 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .14 Do not place load upon new concrete until authorized by DCC Representative.

3.2 COLD WEATHER CONCRETE

- .1 The following are minimum requirements for protecting concrete during and after placement in freezing weather. Except as noted below, concrete curing and protection to be in accordance with CAN/CSA A23.1.
- .2 Before any concrete is placed, all ice, snow, and frost shall be completely removed from all formwork, reinforcing and other surfaces shall be raised above 10°C for 24 hours minimum prior to concreting. Where concrete work is to come in contact with the earth, the surfaces of the earth shall be completely free of frost when the concrete is placed thereon.
- .3 Concrete aggregates and water shall be heated to not over 80°C. Concrete shall not be less than 10°C nor more than 30°C in temperature when deposited. Concrete when placed during freezing weather (or if freezing is anticipated during curing period) shall be fully enclosed and the temperature of same maintained at not less than 5°C for an additional 7 days. Contractor shall provide adequate heating to attain the specified concrete strengths required prior to stripping or to provide a concrete mix which will meet the specified stripping strengths under reduced curing temperatures.

- .4 All protecting covering shall be kept clear of the concrete and form surfaces to permit full circulation of air and shall be maintained intact for at least 24 hours after the artificial heat is discontinued.
- .5 Heating enclosures shall be strong and windproof, but well ventilated, and heating units so located as to prevent local overheating, drying of the concrete, or damage from combustion gases. Only Herman Nelson heat exchange, fuel oil type heaters will be acceptable for slabs and flat areas. Units must be vented outside the building. No direct fired units will be acceptable.

3.3 HOT WEATHER CONCRETE

- .1 Concreting operations during hot weather in accordance with CAN/CSA A23.1.
- .2 Exercise particular care to prevent surface crazing of floor slabs due to combined high temperature and drying winds.
- .3 Use of water reducing-retarding chemical admixture in concrete mix may be required at DCC Representative's discretion.

3.4 CONCRETE INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by DCC Representative.
 - .2 Where approved by DCC Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by DCC Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from DCC Representative before placing of concrete.
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from DCC Representative.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout or epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

- .4 Drainage holes and weep holes:
 - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .6 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by DCC Representative and those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
 - .4 Finish concrete floor to CSA A23.1/A23.2.
 - .5 Concrete floor to have finish hardness equal to or greater than Mohs hardness to CSA A23.1/A23.2.
 - .6 Provide swirl-trowelled finish unless otherwise indicated.
 - .7 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
- .7 Waterstops:
 - .1 Install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.
 - .4 Use equipment to manufacturer's requirements to field splice waterstops.
 - .5 Tie waterstops rigidly in place.
 - .6 Use only straight heat sealed butt joints in field.
 - .7 Use factory welded corners and intersections unless otherwise approved by DCC Representative.
- .8 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by DCC Representative.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form isolation, construction, and expansion joints as indicated.
 - .4 Install joint filler.
 - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

- .9 Dampproof membrane:
 - .1 Install dampproof membrane in accordance with Section 07 13 52 - Modified Bituminous Sheet Waterproofing.
- .10 Surface Tolerance:
 - .1 Concrete tolerance to CSA A23.1.
- .11 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 - SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 or 7 and 56 days.
 - .5 Air and concrete temperature.
 - .2 Provide inspection and testing of concrete and concrete materials, carried out by testing laboratory for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
 - .2 Provide results to DCC Representative.
 - .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and DCC Representative.
 - .4 Contractor will pay for costs of tests except as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .5 Contractor 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 will not augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

3.5 INSTALLATION - ACCESSORIES

- .1 Detectable Warning Tiles: in accordance with manufacturer's written instructions.

3.6 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

- .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from DCC Representative.
- .2 Provide appropriate area on job site where concrete trucks can be safely washed.
- .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collection site as approved by DCC Representative.
- .4 Do not dispose of unused admixtures 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 admixtures and additive materials from entering drinking water supplies or streams.
- .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.
- .7 Dispose of waste in accordance with applicable local, Provincial and National regulations.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American Concrete Institute (ACI):
 - .1 ACI 117-10, Specification for Tolerances for Concrete Construction and Materials (ACI 117-10) and Commentary
 - .2 ACI 301-20, Specifications for Concrete Construction
- .2 ASTM International (ASTM):
 - .1 ASTM C171-20, Standard Specification for Sheet Materials for Curing Concrete
 - .2 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - .3 ASTM C1107/C1107M-20, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - .4 ASTM C1315-19, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
 - .5 ASTM D3575-20, Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers
 - .6 ASTM D4819-13(2021)e1, Standard Specification for Flexible Cellular Materials Made From Polyolefin Plastics
 - .7 ASTM D8139-23, Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
 - .8 ASTM E1155/E1155M-23, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers
- .3 CSA Group (CSA):
 - .1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with Section 03 30 00 - Cast-in-Place Concrete for wet curing.
 - .2 Coordinate concrete curing accelerators with integral concrete colour material to avoid detrimental chemical interactions.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Product Data: Product literature and data sheets for concrete finishing products, including product characteristics, performance criteria, finishes, WHMIS SDSs, example warranty documentation, and limitations.
- .3 Manufacturer's instructions:
 - .1 Special delivery, storage, and handling requirements.
 - .2 Installation and Application instructions.
 - .3 Recommended sequencing.
 - .4 Cleaning procedures.
- .4 Qualification Statements:
 - .1 Submit written declaration that concrete floor finishing products used on this project are compatible with subsequently installed finish flooring products and adhesives.

1.4 QUALITY ASSURANCE

- .1 Comply with the requirements of Section 01 43 00 - Quality Assurance.
- .2 Qualifications:
 - .1 Installers and applicators:
 - .1 Subcontractor with adequate equipment and skilled workers to perform the work expeditiously, and with documented previous satisfactory installations similar to that specified.
- .3 Submit proposed quality assurance procedures a minimum of 2 weeks before starting concrete finishing work for review by DCC Representative on the following items:
 - .1 Curing compounds
 - .2 Sealing compounds
- .4 Mock-ups: Erect in accordance with Section 01 43 00 - Quality Assurance.
 - .1 To be integrated into the built works where possible.
 - .2 Minimum size: 1.22 m x 2.44 m.
 - .3 Location: As directed by the DCC Representative.
 - .4 Acceptable mock-ups may remain as part of the Work.
 - .5 In presence of DCC Representative, intentionally damage part of the exposed face for each finish, colour, and texture to demonstrate the proposed techniques and materials to be used for repairs to match adjacent undamaged surfaces.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 SITE CONDITIONS

- .1 Temporary lighting: Provide minimum 1200 W light source, placed 2.5 m above floor surface for each 40 m² of floor being treated.
- .2 Make work area watertight and protect against rain and detrimental weather conditions.
- .3 Temperature: Maintain minimum 10°C ambient temperature for 7 days before installation and a minimum 48 hours after completion of work. Maintain relative humidity at a maximum 40% during both periods. Or as otherwise denoted in the manufacturer's installation or product application guidelines.
- .4 Moisture: Ensure concrete substrate is within moisture limits prescribed by manufacturer guidelines.
- .5 Ventilation: Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .1 Ventilate area of work as recommended by manufacturer's guidelines temporary supply and exhaust fans.
 - .2 Provide continuous ventilation during and after application of treatment.

Part 2 PRODUCTS

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Concrete finishing: to CSA A23.1/A23.2.
- .2 Required floor finishes, to ASTM E1155/E1155M:
 - .1 Floors having an overall F-number of FF 25 x FL 20. Slabs-on-grade.
 - .2 Floors having an overall F-number of FF 30 x FL 25. Concrete toppings applied over slabs.
 - .3 Floors having an overall F-number of FF 25 x FL 20. Roof slab, slope to drain where indicated.

2.2 CURING COMPOUNDS

- .1 Curing compound: to CSA A23.1/A23.2, ASTM C309, waterborne, penetrating, non-film forming, clear, and compatible with floor finishes as scheduled.

2.3 SEALING COMPOUNDS

- .1 Water-based acrylic formulation, premium grade, non-yellowing, clear finish; zero VOC content. To ASTM C309 Type I, and ASTM C1315 Type 1 Class A.

2.4 PATCHING AND REPAIRING MATERIALS

- .1 Repair Mortar - Vertical and Horizontal Locations: Cementitious, polymer-modified, with corrosion inhibitor. Trowel applied, designed for use as structural repair material at parking structures at vertical and horizontal surfaces.
 - .1 Acceptable material:

- .1 ARDEX
 - .2 Euclid
 - .3 SikaTop-122 PLUS.
- .2 Featheredging Materials: polymer-modified, with migrating corrosion inhibitor added, cementitious, two-component, fast-setting, trowel or rub applied, thin-coat mortar for concrete repairs, for skin coats, filling bugholes, honeycombing and for feather edging.
 - .1 Acceptable material:
 - .1 ARDEX
 - .2 Euclid
 - .3 SikaTop-121 PLUS.
- .3 Structural Grout: high-performance, non-shrink, fluid, cementitious grout with silica fume and two-stage shrinkage mechanism; compensating for shrinkage in plastic and hardened states; non-metallic, containing no chlorides and able to be placed at various consistencies ranging from flowable to fluid by adjusting quantity of mix water.
 - .1 Compressive strength to CSA A23.2 at 28 days: Minimum 62 MPa.
 - .2 Bond to steel: > 0.2 MPa.
 - .3 Meets ASTM C1107, Grade C type grouts.
 - .4 Ministry of Transport Ontario approval for use in grouting bridge bearings as well as anchor bars.
- .4 Supply fast-set structural grout, including type 304 stainless steel drop-in anchors and threaded rod to anchor furniture and other fixed equipment. Confirm acceptability of selections prior to ordering and distribution.

2.5 ACCESSORIES

- .1 Water: Potable.
- .2 Isolation and Expansion Joint Fillers:
 - .1 Polypropylene To ASTM D8139, closed cell, semi-rigid.
 - .1 Acceptable material:
 - .1 W.R. Meadows X-FOAM Expansion Joint Filler.
 - .2 SAKRETE Polypropylene Foam Expansion Joint.
 - .3 Nomaco NOMAFLEX.
 - .2 Polyethylene: To ASTM D3575 and ASTM D4819 Type II, closed cell, flexible.13 mm (1/2 in) thick.
- .3 Control Joint Filler: Two-component, epoxy-urethane, load bearing, self-levelling sealant.
 - .1 Acceptable material:
 - .1 Euco Qwikjoint UVR, by Euclid Chemical
 - .2 Loadflex, Sika Canada.

- .3 Planiseal Rapidjoint 15, by Mapei.
- .4 ReziWeld FLEX, W. R. Meadows of Canada.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions:
 - .1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation, and:
 - .1 Verify that concrete slabs and grade beams are ready to receive work and elevations are as indicated on Drawings.

3.2 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Contractor to ensure that adjacent products and finishes are not damaged during installation.
- .2 Surface preparation:
 - .1 Prepare surfaces in accordance with Section 01 71 00 - Examination and Preparation.

3.3 SEALING COMPOUNDS

- .1 Sealing compound is to be applied to all exposed exterior concrete entry and balcony slabs.

3.4 FINISHING AND CURING

- .1 Coordinate with Section 09 30 00 Tiling and Section 09 65 00 Resilient Flooring.
- .2 Finish concrete floor slab surfaces to CSA A23.1/CSA A23.2, Table 21, Class C.
 - .1 Perform float finishing after trowel finishing to the following areas: where indicated for resilient flooring, LVP and ceramic tiling. Float finish requirements as per surface preparation requirements of the finish flooring manufacturer guidelines.
- .3 Finish concrete to CSA A23.1/CSA A23.2.
- .4 Produce as-cast formed finishes in accordance with ACI 301 and as follows:
 - .1 Surface Finish 1.0 (SF-1):
 - .1 Patch voids larger than 38 mm wide or 12.7 mm deep.
 - .2 Remove projections larger than 25 mm.
 - .3 Tie holes to remain unpatched.
 - .4 Provide surface tolerance Class D in accordance with ACI 117.
 - .2 Surface Finish 2.0 (SF-2):
 - .1 Patch voids larger than 19 mm wide or 12.7 mm deep.

- .2 Remove projections larger than 6 mm.
 - .3 Patch tie holes.
 - .4 Provide surface tolerance Class B in accordance with ACI 117.
 - .3 Surface Finish 3.0 (SF-3):
 - .1 Patch voids larger than 16 mm wide or 12.7 mm deep.
 - .2 Remove projections larger than 3 mm.
 - .3 Patch tie holes.
 - .4 Provide surface tolerance Class A in accordance with ACI 117.
- .5 Use procedures reviewed by the DCC Representative, and according to CSA A23.1/CSA A23.2 to remove excess bleed water. Ensure surface is not damaged.
- .6 Cure concrete in accordance with CSA A23.1/CSA A23.2. As required, use curing compounds compatible with applied finish on concrete surfaces. Use sheet materials in accordance with ASTM C171 for curing concrete floor slabs.
 - .1 Submit written declaration of compatibility of compounds used.
- .7 Finish concrete floors to CSA A23.1/CSA A23.2.
- .8 Interior floor slabs: Provide float finish unless indicated otherwise, or as per finish flooring manufacturer guidelines.
- .9 Exterior floor slabs: Provide fine broom finish unless indicated otherwise, or as per finish flooring manufacturer guidelines.
- .10 Exterior concrete edges to be provided with a radius troweled edge.
- .11 Rub exposed sharp edges of concrete with carborundum to produce a minimum 3 mm radius edges unless otherwise indicated.

3.5 ACCESSORIES

- .1 Install joint fillers in accordance with manufacturer's instructions.

3.6 CLEANING

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

3.7 PROTECTION

- .1 Protect finished surfaces in accordance with manufacturer's recommendations.

3.8 SCHEDULES

- .1 Finish Schedule:
 - .1 Surface Finish 1.0 (SF-1):
 - .1 Apply to concrete surfaces not exposed to public view, or where no further covering material applied directly to concrete.
 - .2 Surface Finish 2.0 (SF-2):

- .1 Apply to concrete surfaces exposed to public view, to be covered with a coating or covering material applied directly to concrete.
- .3 Surface Finish 3.0 (SF-3):
 - .1 Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM C1315-19, Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Provide manufacturer's printed product literature and data sheets for concrete sealer; include product characteristics, performance criteria, finish, and limitations.
 - .1 Include application instructions for concrete sealer.

1.3 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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONCRETE SEALER

- .1 Sealer: silane, water repellent, low VOC, UV stable, vapor permeable, penetrating. Concentrated, solvent free, not diluted on site either by water or solvent. Not containing any silicates, fluor silicates, or stearates.
- .2 Properties of hydrophobic impregnation:
 - .1 Aspect: Liquid
 - .2 Colour: Colourless
 - .3 Solids: ~40% active content (ext. tested)
 - .4 Hydrophobic Impregnation:
 - .1 Penetration Depth: Class I (<10 mm)
 - .2 Water Absorption: <7.5%

- .3 Alkali Resistance: <10%
- .4 Drying Rate: Class I (>30%)
- .5 Freeze & Thaw cycles with de-icing salts: Pass
- .5 On Site Penetration Depth: ≥5 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that slab surfaces are ready to receive work as recommended by manufacturer's written recommendations.

3.2 PREPARATION

- .1 Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.
- .2 Protect adjacent surfaces not designated to receive curing and sealing compound.
- .3 Clean and prepare surfaces to receive curing and sealing compound in accordance with manufacturer's instructions, ensuring stains, oil, grease, form release agents, dust and dirt removed prior to application.
- .4 Ensure surface is clean and free from powdered release agent residue.
- .5 Ensure proper temperature of ambient air and substrate for applications:
 - .1 Ambient Air Temperature: 5 °C (40 °F) min. / 35 °C (95 °F) max.
 - .2 Substrate Temperature: 5 °C (40 °F) min. / 35 °C (95 °F) max.

3.3 APPLICATION

- .1 Apply sealer in accordance with manufacturer's recommended rate and instructions.
- .2 Mix or agitate concrete sealer thoroughly avoiding excessive mixing.
- .3 Apply sealer uniformly.
- .4 Prevent puddling; brush or roll out puddling when it occurs.
- .5 Stir occasionally during application to ensure non-slip additive particles remain suspended.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.

- .4 Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

- .1 Restrict foot traffic for minimum 6 hours, 12 hours preferable.
- .2 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM):
 - .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete
- .2 CSA Group (CSA):
 - .1 CSA A23.1:19/CSA A23.2:19, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete
 - .2 CSA A23.4-16, Precast concrete - Materials and construction
 - .3 CSA A3000-18, Cementitious materials compendium

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Product literature and data sheets, including product characteristics, performance criteria, physical sizes, and limitations.
 - .1 Submit Product Data for:
 - .1 Splash blocks.

1.3 QUALITY ASSURANCE

- .1 Certifications:
 - .1 Fabricate and erect precast concrete elements using manufacturing plant certified by CSA in appropriate categories in accordance with CSA A23.4.

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 MANUFACTURED UNITS

- .1 Precast Concrete Splash Blocks: Natural concrete
 - .1 Dimensions: 305 x 760 x 76 mm (12" x 30" x 3").

2.2 MATERIALS

- .1 Portland Cement with min 35% fly ash replacement: To CSA A3000.
- .2 Water: To CSA A23.1/CSA A23.2.
- .3 Aggregates: To CSA A23.1/CSA A23.2.

- .1 Coarse aggregates: Normal.
- .4 Air Entraining Admixture: To ASTM C260/C260M.

2.3 FABRICATION

- .1 Manufacture units to CSA A23.4.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install precast concrete specialties as indicated on Drawings.
- .2 Replace damaged and defective units as directed by the DCC Representative.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 – Cleaning.
- .2 Waste Management:
 - .1 Manage waste in accordance with Section 01 74 19 – Waste Management and Disposal and:
 - .1 Remove damaged and excess concrete for clean fill.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM C472-20, Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete
 - .2 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - .3 ASTM E336-11, Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
 - .4 ASTM E413-16, Classification for Rating Sound Insulation
 - .5 ASTM E492-09e1, Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
 - .6 ASTM E989-21, Standard Classification for Determination of Single-Number Metrics for Impact Noise
 - .7 ASTM E1007-19, Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and datasheet. Include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .2 Submit WHMIS Safety Data Sheets (SDS).
- .3 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.4 QUALITY ASSURANCE

- .1 Ensure product is installed by an applicator approved by manufacturer.
- .2 Notify concrete supplier that gypsum concrete to be poured over flexible resilient membrane. Ensure concrete has quality and formulation to avoid warping and cracking.

1.5 SITE CONDITIONS

- .1 Before, during, and after installation of product, enclose building interior with adequate ventilation and heat maintained at temperature above 10 degrees C (50 degrees F) to allow for drying of product.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Underlayment mix: tested for slump with 50 mm x 101 mm cylinder resulting in a patty size of 229 mm plus or minus 25 mm diameter.
- .2 Compressive strengths: to ASTM C472, up to 15.2 MPa (2,200 psi).
- .3 Density: 1762-1922 kg/m³ (110-120 lbs./ft³).
- .4 Sound control:
 - .1 Minimum sound transmission class: to ASTM E90 and ASTM E336, 50STC (45 if field tested).
 - .2 Minimum impact insulation class: to ASTM E492 and ASTM E1007, 50 IIC (45 if field tested).

2.2 MATERIALS

- .1 Acoustic mat membrane: elastomeric bitumen and rubber. Adhesive strips and tape as recommended by manufacturer.
 - .1 Does not negate fire rating specified in UL design.

- .2 Apparent sound transmission class: to ASTM E336 and ASTM E413.
- .3 Apparent impact insulation class: to ASTM E1007 and ASTM E989.
- .4 Thickness: 6 mm (0.25 inch).
- .2 Poured flooring underlayment and topping products:
 - .1 Floor Underlayment: gypsum concrete.
 - .2 Floor primer as recommended by manufacturer.
 - .3 Potable water.
 - .4 Sand aggregate.
 - .5 Primer sealer as recommended by manufacturer, for glue down floors.
 - .6 Reinforcement: according to manufacturer's recommendations.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

- .1 Enclose building, including roof, windows, doors, and any other apertures.
- .2 Ensure the substrate is structurally sound, properly fastened, and dry.
- .3 Clean substrate to remove mud, oil, grease, and other contaminating factors before application.

3.3 INSTALLATION

- .1 Install in accordance with current printed manufacturer's instructions.
- .2 Acoustic mat membrane installation: Install according to manufacturer's recommendations and specifications.
 - .1 Install mat membrane with rubber facing down.
 - .2 Begin installation at walls with self-adhesive strip.
 - .3 Lay subsequent lengths one by one, using the self-adhesive, non-granulated overlaps.
 - .4 Edge of new rolls must join with, but not overlap, previous rolls.

- .5 Seal joints with construction tape.
- .3 Mix and apply gypsum concrete according to product manufacturer's recommendations.
- .4 Cementitious gypsum floor topping to be applied to an average thickness of 25.4mm (1 inch). Minimum and maximum thickness due to subfloor variation shall not exceed manufacturers recommendations.
- .5 Immediately spread and screed product to a smooth surface.
 - .1 Expansion joints in all types of work shall be brought through the underlayment.
- .6 Drying: provide and maintain correct environmental conditions to keep the building clean and dry and protect against infestation of moisture.
 - .1 Supply necessary mechanical ventilation and heat to remove moisture from area until product is dry.
- .7 Protection from heavy loads: During construction, place temporary wood planking over product when subject to heavy wheeled or concentrated loads.

3.4 PREPARATION FOR INSTALLATION OF GLUE-DOWN FLOOR FINISHES

- .1 Sealing: Seal all areas to receive glue-down floors good with primer sealer as recommended by manufacturer.
 - .1 Clean and seal any floor with surface damage regardless of floor covering to be used.
 - .2 Where floor goods manufacturers require special adhesive or installation systems, their requirements supersede these recommendations.
- .2 Moisture Testing: Follow respective floor goods manufacturers' recommendations for relative humidity requirements.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International (ASTM):
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .2 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - .3 ASTM C119-23, Standard Terminology Relating to Dimension Stone
 - .4 ASTM C144-18, Standard Specification for Aggregate for Masonry Mortar
 - .5 ASTM C207-24, Standard Specification for Hydrated Lime for Masonry Purposes
 - .6 ASTM C568/C568M-22, Standard Specification for Limestone Dimension Stone
- .2 CSA Group (CSA):
 - .1 CAN/CSA-A370:14, Connectors for Masonry
 - .2 CAN/CSA-A371-14, Masonry Construction for Buildings
 - .3 CAN/CSA-A3000:23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

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 quarried stone veneer cladding and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS SDS.
- .3 Shop Drawings:
 - .1 Indicate sizes and sections of stone veneer, arrangements of joints and bonding, anchoring, dowelling, and cramping.
- .4 Samples:
 - .1 Submit sample for each finish product specified, 2 complete sets representing manufacturer's full range of available colours, textures, and patterns.
- .5 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit manufacturer's instructions for care, cleaning and maintenance of prefaced masonry units for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 43 00 - Quality Assurance:
 - .1 Construct mock-up panel of exterior quarried stone veneer construction 1200 x 1800 mm, showing colours and textures, use of reinforcement, ties, through wall flashing, weep holes, jointing, coursing, mortar, and quality of work.
 - .2 Mock-up used:
 - .1 To judge quality of work, substrate preparation, operation of equipment and material application.
 - .2 For testing to determine compliance with performance requirements.
 - .3 Construct mock-up where directed by DCC Representative.
 - .4 Allow for inspection of mock-up by DCC Representative before proceeding with work.
 - .5 When accepted by DCC Representative, mock-up to demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
 - .6 Start work only upon receipt of written acceptance of mock-up 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.
- .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 quarried stone veneer cladding from nicks, scratches, and blemishes.

1.6 SITE CONDITIONS

- .1 Ambient Conditions:

- .1 Do not install at temperatures below 12 degrees C or above 38 degrees C.
- .2 Maintain temperatures at or above 12 degrees C until cementitious materials have fully cured.
- .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°C and 50°C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and its constituent materials between 5°C and 50°C and protect site from windchill.
 - .3 Maintain temperature of masonry above 0°C for minimum of 7 days, after mortar is installed.
 - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10°C, before applying mortar.
- .4 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .5 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.
- .6 Site Measurements:
 - .1 Make site measurements necessary to ensure proper fit of members.

Part 2 Products

2.1 MATERIALS

- .1 Limestone, medium density limestone, to ASTM C119 and ASTM C568.
 - .1 Unit sizes:
 - .1 Length: random.
 - .2 Depth: 90 mm.
 - .3 Height: 3 courses mix of 55 mm, 125 mm, and 190 mm.
 - .2 Free from all defects affecting appearance or durability.
 - .3 Quarry seams well back from finished face.
 - .4 Fossils and other natural markings not to disfigure finished appearance. Loose or large white fossils not permitted. For fossils and other natural

- markings greater than 30mm in size, notify DCC Representative for direction on use and placement.
- .5 Colour: Grey, to be determined by DCC Representative.
- .6 Grade: Standard.
- .2 Sills:
 - .1 Unit sizes and details, as indicated in drawings.
- .3 Anchors, Cramps, Dowels: to CSA A370, ASTM A123. L-plate, V-tie and 100% recycled polyethylene insulation support, thermally broken, 16-gauge sheet steel 1.367 mm (0.0538") minimum base steel thickness, hot-dip galvanized finish.
 - .1 Vertically adjustable: 36 mm (1.4").
 - .2 Hot-dip galvanized finish weight to ASTM A153, Class B.
- .4 Insulation: Refer to 07 21 13 - Board Insulation.
- .5 Sealants: As per manufacturer's installation guidelines.
- .6 Mortar Diverters:
 - .1 Mortar net, structural strand polymer mesh with insect barrier.
- .7 Weep vents: Cellular, honeycomb design, polypropylene weep vents for embedding in masonry wall mortar joints.
 - .1 Material: High density polyethylene and impervious to water and resistant to UV degradation.
 - .2 Colour as selected by DCC Representative from manufacturer's standard range.

2.2 MORTAR AND ADHESIVE MATERIALS

- .1 Portland Cement: To CAN/CSA-A3000, type GU. White, non-staining.
- .2 Sand: To ASTM C144, passing 16 mesh.
- .3 Hydrated Lime: To ASTM C207, Type S.
- .4 Water: Potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.
- .5 Bond Breaker: Preformed, compressible, resilient, non staining, non waxing, closed-cell polyethylene foam pad, non absorbent to liquid and gas, 3.2 mm thick or polyethylene sheet, 6 to 10 mil thick.
- .6 Approved Mortar Mixes. Mortar mix design to be sent to DCC Representative for review.
 - .1 Mortar Mix for Setting: 1 One (1) part white non-staining cement, One (1) part lime. Six (6) parts sand.
 - .2 One (1) part approved white non-staining premixed masonry cement. Three (3) parts sand.

2.3 FABRICATION

- .1 Shop/Factory Finishing:
 - .1 Manufactured accurately to sizes, shapes, and details as indicated on drawings. Except where drawings call for slopes, angles or curves, cut all stone square, with exposed faces true, beds and joints dressed straight and at right angles to faces.
 - .2 Number each stone on the back or bed with non-staining paint to correspond to numbering on setting drawings.
 - .3 Projecting stone, steps, sills and copings shall be cut for setting on its natural bed.
- .2 Face Finish:
 - .1 Split, as noted on drawings.

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 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for quarried stone veneer cladding 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.
- .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 finished materials from damage due to masonry work.
- .4 Back-check stone contacting structural members as indicated. Allow minimum of 25 mm.

3.4 INSTALLATION

- .1 Construction in accordance with CAN/CSA-A371.

.2 Setting Cut Stone

- .1 Brush stone free of dust, dampen slightly and set stone in accordance with approved setting drawings and numbered stones.
- .2 Install anchors, dowels, cramps, clips, etc. as shown on drawings.
- .3 Use Red Seal Journeyman bricklayers only and set stone plumb, true and level, with joints, anchor and holes flushed full with mortar.
- .4 All joints shall be 10 mm wide except where otherwise indicated.
- .5 Back check stone as required for all structural work as indicated on drawings.
- .6 Cut holes and sinkages as required for anchors, cramps and dowels, etc.
- .7 Cut and drill stone as required for the installations of electrical and mechanical work.
- .8 Do not build up stone facing more than one course above backing.
- .9 Use wood wedges (fully expanded by soaking where necessary to prevent crushing mortar under heavy stones.
- .10 Projecting stones shall be propped or anchored until wall above is set.
- .11 Set ends only of lugged sills or steps in full bed of mortar, balance of bed shall be free of mortar until pointed.
- .12 Slip sills shall have a full bed of mortar.
- .13 After setting stone, rake mortar out of face joints to depth of 20 mm to allow for pointing.
- .14 All mortar splashed on exposed stone faces to be removed at once with sponge and water.

.3 Pointing

- .1 Brush raked out joints clean, remove wedges, fill joints with pointing mortar, pack, work into joints, and finish concave with pointing tool.

3.5 TOLERANCES

- .1 To CAN/CSA-A371.

3.6 QUALITY CONTROL

- .1 After setting, protect projecting areas, corner, etc. with boards. Cover walls at night during rains.
- .2 Site Tests, Inspection:
 - .1 Perform site inspection and testing in accordance with Section 01 45 00 - Quality Control.
 - .2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

3.7 CLEANING

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

- .2 Each day brush completed stonework clean with fibre bristle brushes, preferably dry, or with minimum amount of clean water. Do not use wire brushes, acids, or acidic or alkaline cleaning compounds.
- .3 At completion, wash stonework with stiff-fibre brushes and clean water.
- .4 Leave Work area clean at end of each day.
- .5 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .6 Waste Management: in accordance with Section 01 74 19 - Waste Management and Disposal.

3.8 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 workday. Anchor securely in position.
 - .3 Air Temperature Protection: protect completed masonry as recommended in Site Conditions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 09 91 00 Painting

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM A53/A53M-24, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .3 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- .2 CSA Group:
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No.1 (2014)
 - .2 CSA W48:23, Filler Metals and Allied Materials for Metal Arc Welding
 - .3 CSA W59-24, Welded Steel Construction
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

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 bollards. Include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit two copies of WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:
 - .1 Indicate materials, core thicknesses, finishes, connections, method of anchorage, supports, reinforcement, details, and accessories.
 - .2 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .1 Refer to Section 01 35 73 – Delegated Design.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with the manufacturer's written instructions.
- .2 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 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.

2.2 PIPE RAILINGS

- .1 Fabricate handrails with Schedule 40 steel pipe, in sizes and shapes as indicated.
- .2 Fabricate handrails to support concentrated load of 90 kg applied at top of handrail.
- .3 Galvanize exterior pipe railings to ASTM A123/A123M after fabrication. Shop prime paint interior railings after fabrication.
- .4 Paint finish: Section 09 91 00 - Painting.

2.3 MISCELLANEOUS FABRICATIONS

- .1 Miscellaneous framing and supports: Provide steel framing and supports for applications indicated that are not part of structural steel framework, as required to complete work.
- .2 Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitred joints for

field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

- .3 Steel finish: hot dipped galvanizing with zinc coating to ASTM A123/A123M.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions are acceptable for bollard installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Purchaser's Project Manager of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

- .1 Erect square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .2 Supply components for work by other trades in accordance with shop drawings and schedule.
- .3 Deliver items over for casting into concrete together with setting templates to appropriate location and construction personnel.

3.3 PIPE RAILINGS

- .1 Install pipe railings in locations as indicated.

3.4 MISCELLANEOUS FABRICATIONS

- .1 Install miscellaneous framing and supports to openings as required and as indicated.

3.5 CLEANING

- .1 Progress Cleaning: 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 recycling.
 - .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 bollard installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 80 00 - Glazing

1.2 REFERENCES

- .1 Aluminum Association (AA):
 - .1 AA ADM-2020, Aluminum Design Manual, 2020 Edition
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B32-20, Standard Specification for Solder Metal
 - .2 ASTM B209/B209M-21a, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - .3 ASTM B221/B221M-21, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - .4 ASTM B429/B429M-20, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
 - .5 ASTM D1187/D1187M-97(2018), Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
 - .6 ASTM E935-21, Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings
 - .7 ASTM E2353-21, Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades
 - .8 ASTM E2358-24, Standard Specification for the Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades
 - .9 ASTM F468-23, Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use
 - .10 ASTM F3125/F3125M-23, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
- .3 CSA Group (CSA):
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No.1 (2014)
 - .2 CSA S16:19, Design of steel structures
 - .3 CSA S157-17/S157.1-17, Strength Design in Aluminum / Commentary on CSA S157-17, Strength Design in Aluminum
 - .4 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel
 - .5 CSA W47.2-11. Certification of companies for fusion welding of aluminum, Includes Update No. 1 (2011), Update No. 2 (2012)

- .6 CSA W59-24, Welded Steel Construction
- .7 CSA W59.2:24, Welded Aluminum Construction
- .8 CSA W55.3-08, Certification of companies for resistance welding of steel and aluminum
- .4 National Association of Architectural Metal Manufacturers (NAAMM):
 - .1 NAAMM AMP 510-92, Metal Stairs Manual

1.3 DESIGN REQUIREMENTS

- .1 Design in accordance with Aluminum Design Manual, CSA S157/S157.1, ASTM E2358, and other requirements of authorities having jurisdiction.
- .2 Design assemblies and connections to meet or exceed Code requirements without failure or damage to any component in assembly.
- .3 Maximum deflection for individual members maximum 1/360th of span. Maintain adequate clearances for glass with deflection of members when under full loads.
- .4 Design for anticipated deflections and dimensional changes from temperature variations and building movements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and data sheets.
- .3 Submit shop drawings:
 - .1 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .2 Submit shop drawings for work of this Section, including full scale glazing details. Details shall show aluminum railing system, glass and glazing materials, glass retainers, and anchorages. Indicate fabrication and construction details, layout, sizes, sections, materials, thicknesses, finishes, connections, joints, locations of joints, method of anchorage, number of anchors, supports, welds, reinforcement, details, relationship and connections to adjacent materials and work, accessories, sizes of sections to be delivered and other pertinent data.
 - .1 Refer to Section 01 35 73 – Delegated Design.
 - .3 Show details of attachment to structure, including engineering calculations.
- .4 Submit samples:
 - .1 Submit two samples, minimum size 150 mm square, representing actual product, color, and patterns.

- .5 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions and special handling criteria, and cleaning procedures.
- .6 Submit necessary templates and instructions where fastenings or anchors are required to be cast-in or built-in by other trades.
- .7 Submit adequate written instructions for protection of completed work, for re-glazing, and for proper methods and materials to be used in cleaning.

1.5 QUALITY ASSURANCE

- .1 Retain a Professional Engineer, registered in Province of Ontario, to design fabrication and erection of Work of this Section in accordance with provincial codes and amendments and requirements of this Section. Sign and seal shop drawings and design submittals. Review installations.
- .2 Work of this Section to be done by metal fabricators specialized in high quality custom architectural metal work and glazing and having previous successful experience in type of work specified.
- .3 Perform aluminum welding to CSA W59.2 by companies certified under CSA W47.2 and CSA W55.3.

1.6 MOCK-UP

- .1 Mock-ups:
 - .1 Construct mock-up in accordance with Section 01 43 00 - Quality Assurance.
 - .2 Construct typical sample installation of glazed railing.
 - .3 Locate where directed.
 - .4 Mock-up may remain as part of finished work.
 - .5 Allow for review of mock-up by DCC Representative before proceeding with Work of this Section.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
- .3 Replace defective or damaged materials with new.
- .4 Provide protective covering to finished surfaces. Remove protection when installed work is ready for final review. Do not use protective coatings that will damage finishes or become permanently bonded. Do not leave coating residue on surfaces.

1.8 AMBIENT CONDITIONS

- .1 Maintain environmental conditions including temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results.

Part 2 Products

2.1 PERFORMANCE AND DESIGN CRITERIA

- .1 Provide delegated design as required.
- .2 Comply with CISC Code of Standard Practice for Structural Steel, Appendix I, Architecturally Exposed Structural Steel.
- .3 Structural Performance: design, fabricate, and install railing systems to withstand for vertical and horizontal live load requirements as required by the National Building Code of Canada (NBCC), and passing tests prescribed by ASTM E2353.
- .4 Installed railing assembly and attachments must be able to resist a minimum outward lateral force according to National Building Code of Canada, and test in accordance with ASTM E935.

2.2 MATERIALS

- .1 Structural steel: CSA G40.20/G40.21, grade 350W.
- .2 Aluminum extrusions: to ASTM B221/B221M, alloy 6063-T5; 6061-T6 for structural applications.
- .3 Aluminum sheet and plate: to ASTM B209/B209M, alloy 6063-T5; 6061-T6 for structural applications.
- .4 Aluminum tube and pipe: to ASTM B429/B429M, alloy 6063-T5; 6061-T6 for structural applications; pipe to NPS Schedule 40.
- .5 Fittings: wrought material of aluminum.
 - .1 Mitre elbows: welded construction.
- .6 End caps, mitred elbows and edge protectors for balustrade assembly as indicated on drawings.

- .7 Glass and Glazing: refer to Section 08 80 00.
- .8 Fasteners:
 - .1 Structural bolts: to ASTM F3125/F3125M.
 - .2 Aluminum fasteners: to ASTM F468, alloy 6063-T5; 6061-T6 for structural applications.
 - .3 Aluminum fasteners with caps: custom aluminum fabrications to suit project requirements of same material, finished to match adjacent metal finishes. Fasteners, screw or bolt type with threaded caps, tamper resistant after installation, allow for removal of glass for replacement.
 - .4 Bolts, screws, nuts, washers, and other fasteners: Stainless steel of austenitic grade, 300 Series. Galvanized fasteners may be used for galvanized components. Fasteners at exposed locations where permitted shall be finished to match adjacent metal finishes.
 - .5 Mounting: adjustable aluminum brackets and flanges, with aluminum inserts, brackets and/or backing plates as appropriate for substrate and construction.
 - .6 Splice connectors: concealed aluminum.
- .9 Welding materials: to CSA W59.2 for aluminum; CSA W59 for steel.
 - .1 Welding rods shall be of same material composition or slightly higher chromium-nickel content than hardness to suit conditions.
 - .2 Solder and flux: to ASTM B32, alloy composition 85 Tin/15 Zinc for aluminum. Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.
- .10 Joint Sealants: to Section 07 92 00.
- .11 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours; 40 MPa at 28 days.
- .12 Emulsified asphalt protective coating for metals to provide dielectric separation: to ASTM D1187/D1187M.

2.3 FABRICATION

- .1 Verify all dimensions and conditions on site prior to preparing shop drawings or proceeding with shop work; fabricate to suit. Fit and shop assemble and deliver to the site in largest practical sections.
- .2 Fabricate items to accommodate and interface with work specified in other Sections. Maintain accurate alignment, proper tolerances, and clearances.
- .3 Maintain lines, profiles and alignments shown.
- .4 Accurately fit, and rigidly frame together all joints, corners, and mitres. Match components carefully to produce perfect continuity of line and design.

- .5 Design and fabricate components to allow for expansion and contraction. Provide necessary rebates, lugs, and brackets for assembly of units.
- .6 Fabricate true to dimensions, square or uniformly curved. Accurately fit members with hairline joints and join using adequate fastenings.
- .7 Use concealed fastening wherever possible unless otherwise approved.
- .8 Construct finished work free from distortion and defects detrimental to appearance and/or performance. Maintain flat or uniformly curved surfaces without scratches or dents.
- .9 Match finished formed edges where exposed with adjacent finish after fabrication or forming. Bends shall be straight, true, and level, with uniform radiuses.
- .10 Cut surfaces shall be equal in smoothness to a mill finish.
- .11 Accurately form connections with exposed faces flush; mitres and joints tight; contour cut joints; accurately form curved components to required radii, ensure curves and diameters are uniform.
- .12 Make copes, mitres and butt cuts in surfaces exposed to view within the closest possible tolerances consistent with shop equipment and practice. Plan erection sequences so that tolerances can be maintained.
- .13 Where the fit-up of adjacent members is such that permissible tolerances specified above may result in any unsightly joint, take special care to obtain a visual plane on the exposed surfaces. If both sides are exposed, detail joints in such a way as to minimize these unavoidable variations.
- .14 Welding: Except as otherwise shown on the Drawings, shop and field assembly shall be done by welding. Where not detailed, connections in accordance with OBC, CSA S16 and AA ADM-2020.
 - .1 Weld in accordance with CSA W59 for steel and CSA W59.2 for aluminum.
 - .2 Weld using qualified welders certified in accordance with the requirements of CSA W47.1, CSA W47.2 and CSA W55.3 as applicable.
 - .3 Welded joints of adequate strength and durability with jointing tight.
 - .4 Where it is necessary to weld components already galvanized, remove galvanizing for 50 mm (2") around weld and paint over welds where galvanizing has been removed.
 - .5 No weld marks visible when fittings installed.
 - .6 Provide continuous welds for length of each joint unless otherwise approved.
 - .7 Grind welds and finish smooth and flush to match adjacent surfaces, free of grind marks.

- .8 Where non-continuous welds are permitted, fill all such joints with metallic paste filler and sand smooth and flush, free of sanding marks.
- .15 Construct internal and external corners with sharp lines unless indicated otherwise.
- .16 Fastenings:
 - .1 Fabricate metalwork complete with all components required for anchoring in a safe and secure manner.
 - .2 Supply fastenings, brackets, anchors and accessories required for fabrication and erection of work specified in this Section.
 - .3 Components and materials shall be free of undue stress on members and anchors.
 - .4 Fastening methods shall not interfere with architectural lines and finishes.
 - .5 Provide countersunk exposed fastenings, where such are acceptable and shown on final reviewed shop drawings and make as inconspicuous as possible. Do not utilize projecting fastenings that would be unsafe or detrimental to appearance in finished work.
 - .6 Construct fastenings of the same material, or compatible material, and finish as the base material on which they occur. Fasteners shall be mechanical fixings, adequate for purpose, tamper resistant, rust resistant and non-staining. Keep exposed fastening to absolute minimum, evenly spaced and neatly laid out.
- .17 Finished architectural metal fabrications shall be free from visual and other defects such as dents, bumps, surface irregularities and other such flaws. Surfaces shall be uniform and shall match approved samples. Joints shall be welded and undetectable in the finished work. Finished work shall be sturdy, rigid and secure.
- .18 Do not use glass having objectionable surface distortion.
- .19 Glazed Guards/Balustrades:
 - .1 Accurately size glass to fit openings allowing the required clearances.
 - .2 Calculate glass size, thickness, face clearance, glazing bite and tolerances, in accordance with manufacturer's instructions.
 - .3 Provide polished pencil round edge to glass edges exposed in the finished work.
 - .4 Fabricate railings, guards and balustrades of welded construction as detailed. Fabricate railing assemblies that interface with existing to match existing.
 - .5 Construct glazed aluminum guards/balustrades as detailed.
 - .6 Ends of hollow railings shall have closure plates continuously welded to railing.

- .7 Provide panel clips to accommodate glazing conditions without stress on glass. Clips shall allow removal and replacement of glazing and metal panels.

2.4 FINISHES

- .1 Prime painting steel components:
 - .1 After fabrication, thoroughly descale all ferrous steel work. Remove any roughness and irregularities by grinding, clean with a wire brush, remove oil and grease and apply one 1.5 to 0.05 mm (2 mils) thick shop-coat of priming paint.
 - .2 Provide smooth finish at architectural steel stair, and steel railings and balustrades, free of all grinding marks and other imperfections.
- .2 Do not prime:
 - .1 Prefinished aluminum;
 - .2 Steel to be encased in concrete;
 - .3 Surfaces and edges to be field welded. If painted, remove paint for field welding for a distance of at least 50 mm (2") on all sides of the joint.
- .3 Exposed aluminum finish:
 - .1 High-Performance Organic Finish:
 - .1 Colour: as selected by DCC Representative.
- .4 Finish steel clips and reinforcing steel with steel primer, except areas to be welded, applied in accordance with manufacturer's instructions.

Part 3 Execution

3.1 COMPLIANCE

- .1 Installation shall be in accordance with manufacturer's printed installation instructions, data sheets, standard or non-standard details (modified as required to suit project), and specifications.
- .2 Execution of the work shall conform to the specifications, recommendations, and guidelines of NAAMM AMP 510, Metal Stair Manual.

3.2 EXAMINATION

- .1 Verify that field conditions are acceptable and are ready to receive work.
- .2 Verify that reinforcement and anchoring devices are the correct type, have been located correctly, and have been installed properly.
- .3 Notify DCC Representative of unsatisfactory conditions. Commencement of work means acceptance of conditions.

3.3 PREPARATION

- .1 Supply items required to be cast into concrete, including back plates for installation at steel stud and gypsum board assemblies.
- .2 Prepare surrounding construction to receive railing system installations to comply with manufacturer's requirements.
- .3 Review and coordinate setting drawings, shop drawings, templates, and instructions for assembly and installation of railing system and related items to be embedded in concrete and masonry.
- .4 Paint bronze, nickel - silver, and aluminum components that come into contact with dissimilar metals with a heavy coat of suitable primer.
- .5 Paint exposed aluminum components that come into contact with cement or lime mortar, with zinc chromate (supply and install as required).

3.4 INSTALLATION

- .1 Install railing systems in proper locations and positions, structurally sound, securely fastened, free from defects detrimental to finished appearance.
- .2 Erect components square, plumb, straight, level, and true, accurately fitted, with tight joints and intersections. Use welded connections wherever possible.
- .3 Do all drilling, cutting and fitting necessary to attach this work to adjacent work. Install plates, brackets, fastenings, anchors and supports adequate.
- .4 Separate aluminum from building materials where electrolytic action may occur by means of asphaltic paint or other approved method.
- .5 Provide for thermal expansion and contraction by use of expansion joints or gaps in rails. Comply with manufacturer's instructions for locations of expansion joints and fastening of expansion sleeves.
- .6 Install bottom rails in un-spliced lengths between posts.
- .7 Install posts of continuous sections from mounting base to top rail.

3.5 ERECTION TOLERANCES

- .1 Maximum variation from plumb shall be 6 mm.
- .2 Maximum offset from true alignment for every 15.24 m (50 feet) of railing shall be 6 mm, non-accumulative.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning. Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

3.8 SCHEDULE

- .1 Install at terraces and balconies, and as indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Air and Vapour Barriers
- .2 Section 07 54 00 - Thermoplastic Membrane
- .3 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME):
 - .1 ASME B18.6.1-1981, Wood Screws (Inch Series)
- .2 ASTM International:
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .2 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - .3 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process
 - .4 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - .5 ASTM D3498-19a, Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing
 - .6 ASTM D3575-20, Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers
 - .7 ASTM D5055-19e1, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists
 - .8 ASTM D5456-19, Standard Specification for Evaluation of Structural Composite Lumber Products
 - .9 ASTM E814-24, Standard Test Method for Fire Tests of Penetration Firestop Systems
 - .10 ASTM F1667-18a, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .3 American Wood-Preservers' Association (AWPA):
 - .1 AWPA M2-19, Standard for the Inspection of Preservative Treated Products for Industrial Use
 - .2 AWPA M4-23, Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products
- .4 CSA Group:
 - .1 CAN/CSA O80-Series-15, Wood Preservation

- .2 CSA O112.9:10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure)
- .3 CSA O121-17, Douglas Fir Plywood
- .4 CSA O141:05, Softwood Lumber
- .5 CSA O151-17, Canadian Softwood Plywood
- .6 CSA O322-15, Procedure for Certification of Pressure-Treated Wood Materials for Use in Preserved Wood Foundations
- .7 CSA O325-16, Construction Sheathing
- .8 CAN/CSA S406-16, Specification of permanent wood foundations for housing and small buildings
- .5 National Lumber Grades Authority (NLGA):
 - .1 NLGA Standard Grading Rules for Canadian Lumber (2017 edition)
- .6 South Coast Air Quality Management District (SCAQMD), California State:
 - .1 SCAQMD Rule 1168-2022, Adhesives and Sealants Applications
- .7 ULC Standards:
 - .1 CAN/ULC-S102-10, Test for Surface Burning Characteristics of Building Materials and Assemblies

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 wood products and accessories. Include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .2 Submit the following for products treated with preservative by pressure impregnation, certified by authorized signing officer of treatment plant:
 - .1 Information listed in AWP A M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWP A M2 applicable to specified treatment.
 - .2 Moisture content after drying following treatment with water-borne preservative.
 - .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.
- .3 Shop Drawings:
 - .1 Submit shop drawings stamped and signed by a Professional Engineer registered or licensed in Ontario, Canada for all wood joists, trusses, engineered wood products, and wood stairs and intermediate landings.
 - .1 Refer to Section 01 35 73 – Delegated Design.
 - .2 Showing layout and detail necessary for determining fit and placement in the building.

- .3 Metal hangers, squash blocking, bridging, blocking, web stiffeners and any other connections or accessories associated with wood joists, trusses, or engineering wood products.

1.4 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB, and wood based composite panels in accordance with CSA and ANSI standards.
- .3 Obtain treated wood products from a single wood treatment facility.
- .4 Pressure Treatment Standards: Use only wood treatments meeting requirements of CAN/CSA-O80 Series and ensure that treated wood products clearly indicate on the face or edge the following labelling requirements in accordance with Wood Preservation Canada and CSA O322:
 - .1 Name of registered treatment.
 - .2 Basic safety instructions.
 - .3 Consumer safety contact information.
 - .4 Grading marks required by wood products.
- .5 All boards or bundles of fire-retardant treated material or panels to be identified with ULC label indicating Flame Spread Classification (FSC) and smoke developed.

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 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wood products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

- .1 Lumber: Softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Plant fabricated structural wood:

- .1 Proprietary prefabricated I-joists of solid, laminated veneer lumber glue laminated lumber flanges or oriented strandboard panel web, with factory pre-punched knock-out holes for electrical services and ventilation holes for roof joists.
- .2 Proprietary prefabricated open web joists consisting of parallel chords and a triangulated web system assembled with finger joinery and waterproof heat rated adhesive, sized as required.
- .3 Adhesive: Exterior rated phenol-formaldehyde or phenol-resorcinol: to CSA O112.9.
- .4 Plant fabrication with quality control in accordance with ASTM D5055.
- .3 Structural Composite Lumber (SCL) in accordance with ASTM D5456, for following uses:
 - .1 Laminated veneer lumber (LVL): headers, beams, hip and valley rafters as indicated.
 - .2 Parallel strand lumber (PSL): beams and headers as indicated.
 - .3 Laminated strand lumber (LSL): studs as indicated.
 - .4 Oriented strand lumber (OSL): studs as indicated.
- .4 Framing and board lumber: in accordance with NBC, except as follows:
 - .1 Architecturally Exposed Lumber: NLGA select grade.
- .5 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Use S2S or S4S materials.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .4 Where indicated, provide pressure treated materials.
- .6 Plywood:
 - .1 Edges: T&G, square, as indicated.
 - .2 Plywood, OSB and wood based composite panels: CSA O325.
 - .3 Douglas fir plywood (DFP): CSA O121, standard construction.
 - .4 Canadian softwood plywood (CSP): CSA O151, standard construction.
- .7 Treated wood products: CSA O80 Series.
- .8 Fire retardant treated plywood: CAN/ULC-S102, Grade AC.
 - .1 Flame spread: Maximum 25.
 - .2 Smoke developed: Maximum 25.

2.2 TREATED PERMANENT WOOD FOUNDATIONS (PWF)

- .1 Use Categories (UC) for treated wood used in construction, in accordance with CSA O80:
 - .1 Interior damp construction: UC2, Clause 9.

- .2 Exterior, above ground construction with uncoated wood products or poor run off of water: UC3.2, Clause 9.2.
- .2 Lumber and panel materials to CAN/CSA S406, preservative treatment to CSA O80.
- .3 Fasteners and connectors and field applied preservative: to CAN/CSA S406, CSA O80, according to manufacturer's recommendations.
- .4 Moisture barrier: refer to Sections 07 25 00 Air and Vapour Barriers.
- .5 Sealant: refer to Section 07 92 00 Joint Sealants.

2.3 ACCESSORIES

- .1 Vapour barrier: Refer to Section 07 25 00 - Air and Vapour Barriers.
- .2 Air seal: Closed cell polyurethane or polyethylene.
- .3 Sill gasket: Polyethylene foam strip, Class A Fire Rating, does not support mold growth, insect resistant, width to suit framing, lengths as required.
 - .1 Vertical compressive strength, tear resistance, and density to ASTM D3575.
 - .2 Water absorption to ASTM D3575-08 Suffix L: <4.75 Pa (0,1 lb/ft²) per 24 hours.
 - .3 R-Value at initial thickness to ASTM C518: min 0.65.
- .4 Sealants: In accordance with Section 07 92 00 - Joint Sealants.
 - .1 Sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .5 General purpose adhesive: CSA O112.9.
 - .1 VOC limit 70 g/L maximum to SCAQMD Rule 1168.
- .6 Subfloor adhesive: ASTM D3498.
- .7 Pest intrusion guard and insect screen. Galvanized steel, 1.1 x 1.3 mm (0.045 x 0.052 inch) screen openings, approximately 66% open area.
- .8 Fasteners:
 - .1 Stainless steel fasteners to be used at all locations where fasteners are penetrating through rigid board insulation. Fastener information including size, type to be provided for review at the submittal stage.
 - .2 Hot dipped galvanized steel to ASTM A123/A123M, ASTM A153/A153M or ASTM A653/A653M for high humidity and treated wood locations, unfinished steel elsewhere.
 - .3 Nails, spikes, and staples: ASTM F1667.
 - .4 Screws: ASME B18.6.1.
 - .5 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
 - .6 Proprietary fasteners: Toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

- .9 Field treatment preservative:
 - .1 For application to machined and cut ends or drilled surfaces meeting the requirements of CAN/CSA O80, and in accordance with AWP A M4. Type recommended by manufacturer to suit specified pressure treated products.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for rough carpentry installation.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

- .1 For field treatment, comply with AWP A M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWP A M2.
- .2 Re-treat surfaces exposed by cutting, trimming, or boring with liberal brush application of preservative before installation.
- .3 Install pressure-treated wood in wet locations and locations where wood will be in contact with concrete.
- .4 Remove chemical deposits from surfaces of treated wood to receive applied finish.

3.3 INSTALLATION - INSULATION FURRING

- .1 Ensure strapping is installed true and plumb.
- .2 Ensure maximized airspace for rainscreen requirements.
- .3 Ensure design of cladding and strapping plane is in accordance with fastening requirements of cladding system supplier.

3.4 FRAMING

- .1 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .2 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- .3 Install members true to line, levels and elevations, square and plumb.
- .4 Construct continuous members from pieces of longest practical length.
- .5 Construct framing and curb members full length without splices.

- .6 Install spanning members with "crown-edge" up.
- .7 Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists. Frame rigidly into joists.
- .8 Use dust collectors and high-quality respirator masks when cutting or sanding wood panels.
- .9 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.
- .10 Countersink bolts where necessary to provide clearance for other work.

3.5 FURRING AND BLOCKING

- .1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, audio-visual equipment mounting, electrical equipment mounting boards, architectural hardware, bathroom accessories, fire extinguisher brackets, and other work as required.
 - .1 Install continuous plywood blocking in stud wall locations as indicated to receive display boards, shelving, and other wall-mounted items.
- .2 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.
 - .1 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .3 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.
- .4 Install wood cants, fascia backing, nailers, curbs, and other wood supports as required and secure using galvanized steel fasteners.
- .5 Install sleepers as indicated.

3.6 CEILING AND WALL SHEATHING

- .1 Install plywood sheathing level and plumb, fastened with ring-shank nails.
- .2 In horizontal applications and on ceilings, stagger joints minimum one stud space.
- .3 Fastener type and spacing as shown and specified on Structural Drawings.

3.7 PANEL TYPE SUBFLOORING

- .1 Install subflooring with panel end joints located on solid bearing, staggered at least 800 mm.
- .2 Apply subflooring adhesive on wood framing to support panel-type subflooring. Place continuous single bead on each framing member and double bead on framing members supporting panel joints. Comply with adhesive manufacturer's installation instructions.
- .3 Fasten subfloor panels using #8 floor screws spaced 150 mm on center along edges and 300 mm on center along intermediate supports.
 - .1 Drywall screws are not permitted for subfloor installation.

3.8 PLYWOOD UNDERLAYMENT FOR CERAMIC TILE FLOORS

- .1 Install Douglas Fir plywood underlayment over wood subfloors at ceramic tile installations in accordance with Section 09 30 00 - Tiling.

3.9 ROOF SHEATHING

- .1 Confirm roof substrate is on continuously denoted plane before installation of plywood sheathing. Refer to drawings for slope. Adjust framing members as necessary to provide a consistent nailing surface.
- .2 Install panels with surface grain perpendicular to roof framing. Stagger end joints.
- .3 Fastener type and spacing as shown and specified on Structural Drawings.
- .4 Install panels with 3 mm (1/8 inch) space between panel ends and no space continuously at edge joints.

3.10 BALCONY SHEATHING

- .1 Confirm substrate is on continuously denoted plane before installation of plywood sheathing. Refer to drawings for slope. Adjust framing members as necessary to provide a consistent nailing surface.
- .2 Install panels with surface grain perpendicular to framing. Stagger end joints.
- .3 Apply sheathing adhesive on wood framing to support panel-type exterior sheathing. Place continuous single bead on each framing member and double bead on framing members supporting panel joints. Comply with adhesive manufacturer's installation instructions.
- .4 Attach plywood sheathing using wood screws, or ring-type or ardox nails.
 - .1 Space fasteners at maximum 150 mm (6 inches) on center at supported sheathing ends and edges unless otherwise specified.
 - .2 Space fasteners at maximum 300 mm (12 inches) on center at intermediate supports unless otherwise specified.
- .5 Install panels with 3 mm (1/8 inch) space between panel ends and no space continuously at edge joints.
- .6 Refer to Section 07 54 00 - Thermoplastic Membrane for manufacturer's acceptable sheathing substrates.

3.11 EQUIPMENT/ELECTRICAL MOUNTING BOARDS

- .1 Material: fire-retardant treated plywood, Grade AC. Extend walls from floor to slab.
 - .1 Size: 1220 x 2440 mm x 19 mm (48 x 96 x ¾ inch).
- .2 Finish: fire retardant paint finish, refer to Section 09 91 00 – Painting; white or to match wall colour unless otherwise specified; finish with two coats on all six surfaces prior to installation to ensure proper sealing.
- .3 Fastening: exposed stainless steel screws with flat heads, countersunk at 400 mm (16 inches) on center unless otherwise specified.

.1 Drywall screws are not acceptable.

.4 Sealant: caulk joints and screw holes with fire-resistive sealant to ASTM E814 in accordance with Section 07 92 00 – Joint Sealants.

3.12 CLEANING

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

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

.3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.

3.13 WASTE MANAGEMENT

.1 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Re-use scrap lumber to the greatest extent possible. Separate scrap lumber for use on site as accessory components, including shims, bracing, and blocking.

.3 Do not leave any wood, shavings, sawdust, or other wood waste on the ground or buried in fill. Prevent saw dust and wood shavings from entering the storm drainage system.

.4 Do not burn scrap lumber that has been pressure treated.

.5 Treated wood:

.1 Do not send lumber treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

.2 Dispose of treated wood waste at a landfill facility licensed to accept pressure preservative treated wood products.

.3 Do not burn or dispose of treated wood on-site by burying.

.4 Do not recycle scrap treated wood.

.5 Do not compost scrap treated wood.

.6 Separate treated wood waste from non preservative treated wood products to prevent contamination of waste stream and storm drainage system.

3.14 PROTECTION

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

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for supply, fabrication, and erection of prefabricated, pre-engineered structural wood products. It also includes design, fabrication and installation of connections associated with the following components:
 - .1 Parallel Strand Lumber (PSL), Laminated Strand Lumber (LSL) and Laminated Veneer Lumber (LVL); and Composite Wood Joists (I-Joists).
 - .2 Pre-engineered, pre-fabricated connectors and fastenings.
 - .3 Accessories, blocking, and other components required for complete installation.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)/The Engineered Wood Association (APA):
 - .1 APA PRI-400-2013, Performance Standard for APA EWS I Joists (Limit States Design), Canadian Edition
 - .2 APA PRI-405-2012, Performance Standard for APA EWS Commercial I-Joists
 - .3 APA PRR-401-2019, Performance Standard for APA Rim Boards
- .2 ASME International (ASME):
 - .1 ASME B18.6.1-1981, Wood Screws (Inch Series)
- .3 ASTM International (ASTM):
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel
 - .2 ASTM A153/A153M 16a, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - .3 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
 - .4 ASTM D5055 19e1, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists
 - .5 ASTM D5456-19, Standard Specification for Evaluation of Structural Composite Lumber Products
 - .6 ASTM F1667-18a, Standard Specification for Driven Fasteners: Nails, Spikes and Staples
- .4 CSA Group (CSA):
 - .1 CSA B111-1974, Wire Nails, Spikes and Staples
 - .2 CSA O86:19, Engineering Design in Wood

- .5 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber 2017.
 - .2 NLGA SPS 1–2023, Fingerjoined Structural Lumber
 - .3 NLGA SPS 2–2024, Machine Graded Lumber
 - .4 NLGA SPS 4–2020, Fingerjoined Machine Graded Lumber

1.3 DEFINITIONS

- .1 Structural Composite Lumber (SCL): Fabricated structural wood units that form the primary structural elements for the Project consisting of columns, beams, joists, purlins, rim boards and accessory components described in this Section that are fabricated under factory-controlled conditions from exterior grade adhesives and strand/veneer wood manufactured in accordance with ASTM D5456.
- .2 Composite Wood Joists (I-Joists): Fabricated structural wood units that form the primary structural elements for the Project consisting of joists, headers, blocking panels and rim boards described in this Section that are fabricated under factory-controlled conditions in accordance with ASTM D5055 and APA PRI–400 and APA PRI–405.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate installation of structural wood products with work specified in other Sections that may have items supported by or built into structural wood components described in this Section as follows:
 - .1 Coordinate temporary protective measures required by this Section to prevent exposure to weather and other deleterious environmental conditions in accordance with Section 01 35 43 – Environmental Procedures.
 - .2 Coordinate installation of structural connections to adjacent building components.
 - .3 Coordinate fabrication of miscellaneous steel, anchorages and fasteners required by shop-fabricated wood components for complete installation dependent on work of any other Section listed under RELATED REQUIREMENTS.
 - .4 Coordinate and interface with other Sections of Work including the following:
 - .1 Transitions to other assemblies
 - .2 Anchorage to structural support components
 - .3 Separation of differing or non compatible materials
 - .4 Sequences of installation
 - .5 Site tolerances
 - .6 Other conditions affecting installation of materials specified in this Section.

- .2 Pre-Construction Meeting: Conduct a pre-construction meeting on site in accordance with Section 01 31 19 – Project Meetings attended by DCC Representative and other Subcontractors affected by work of this Section to verify project requirements, and review methods and procedures related to structural wood products, including the following:
 - .1 Provide a minimum 72 hours notice to DCC Representative before starting work of this Section; increase notice period when notification date occurs on weekends or statutory holidays.
 - .2 Review materials used on the project and any required changes to design for use of different materials than those specified.
 - .3 Review installation, substrate and structure conditions affecting work of this Section.
 - .4 Review requirements of this Section for connection to substrates and structures provided by other Sections.
 - .5 Review of metal fabrications, anchors and fasteners required by and provided by this Section to other components of the Work.
 - .6 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - .7 Review location and alignment of vertical and horizontal elements as they relate to the aesthetic criteria and technical requirements indicated on the shop drawings.
 - .8 Review concealed connection and exposed connection details.
 - .9 Review written installation instruction requirements.
 - .10 Review other or additional installation requirements not otherwise covered by the suggested list of topics.

1.5 SUBMITTALS

- .1 Perform in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals (to be submitted before starting any work of this Section):
 - .1 Product Data:
 - .1 Submit manufacturer's installation instructions and special handling criteria, installation sequence, printed product literature, catalogue pages and data sheets clearly identifying products used for the Project.
 - .2 Shop Drawings:
 - .1 Indicate applicable dimensions, fasteners, erection details and connection materials and finishes.
 - .2 Indicate applicable grades, shop-applied finishes, camber, cuts, ledgers, holes and connection details.
 - .3 Coordinate critical installation conditions and related work required by other Subcontractor or Trade Contractors.

- .4 Indicate temporary bracing required for installation.
- .5 Supporting professional engineer registered or licensed in Ontario, Canada, is required to seal and sign design solutions presented in submitted shop drawings prepared under their supervision.
 - .1 Refer to Section 01 35 73 – Delegated Design.
- .3 Informational Submittals (to be submitted during the course of work):
 - .1 Test and Evaluation Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Source Quality Control Submittals: Submit proof that components and products supplied to the project are obtained from a single manufacturing source, and that accessory connectors are obtained from a manufacturer recommended source.
- .4 Sustainable Design Submittals: provide information supporting Sustainable Characteristics described in Part 2 of this Section.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - .2 Carefully unload materials using forklifts or cranes, to avoid damage.
 - .3 Keep lumber stored in wrapped and strapped bundles stacked not to exceed manufacturer's height restrictions.
 - .4 Support bundles to prevent excessive bowing.
 - .5 Support and separate bundles with 38 mm x 89 mm or larger dimension lumber spaced in accordance with manufacturer's written instructions.
 - .6 Keep wrapping in place until right before installation of materials; slit wrapping on underside to prevent moisture build up.
- .2 Storage and Handling Requirements:
 - .1 Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 - .2 Keep materials dry.
 - .3 Handle individual pieces to prevent physical damage during measuring, cutting and erection; use padded or non-marring slings when lifting.
 - .4 Store components on a hard, dry, level surface.
 - .5 Do not store components in contact with the ground.
 - .6 Do not allow components to have prolonged exposure to weather.
 - .7 Protect corners using wood blocking.

- .3 Packaging Waste Management: in accordance with Section 01 74 19 - Waste Management and Disposal.

1.7 SITE CONDITIONS

- .1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where anchorages, connectors and other structural components are indicated to fit between or around other construction, or embedded into other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Dimensions: Establish dimensions and proceed with fabricating glued-laminated construction systems without site measurements where doing so would delay the Work; coordinate construction so that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 DESCRIPTION

- .1 Regulatory Requirements
 - .1 Manufacture shop-fabricated structural wood in accordance with ASTM D5055 and ASTM D5456, or proprietary Products in plant certified by certification agency accredited by the Standards Council of Canada; and bearing accredited stamp noting the name and plant number of manufacturers, grade, and Canadian Construction Materials Centre (CCMC) certificate number (if applicable) and quality control agency.

2.2 DESIGN CRITERIA

- .1 Source Limitation: Obtain shop fabricated structural wood components and accessories from a single manufacturing source and manufacturer recommended connectors source.
- .2 Lumber Grades: Provide lumber products that are all sides finished (S4S) in nominal dimensions required for the project; grade marked by accredited agencies of the Canadian Lumber Standards Accreditation Board and conform to National Grading Rules published by the National Lumber Grades Authority (NLGA), and as follows:
 - .1 Grading: Machine grading, visual grading, or both based on material type.
 - .2 Moisture Content: Kiln dry, 19% or less.
 - .3 Structural Design Properties: Strength and related properties in accordance with CSA O86 and NLGA SPS 2.
 - .4 Acceptable Alternative Products: Lumber products meeting requirements of the American Lumber Standards Committee designated ALS Program Lumber and that are accepted by the Canadian Lumber Standards Accreditation Board may be acceptable for the Project when proof of

compliance with strength and related properties meeting CSA O86 are submitted before purchasing any structural wood Products.

- .3 Finger-jointed Lumber:
 - .1 Provide machine-graded lumber (MSR) products meeting requirements of NLGA SPS 1 and SPS 4 acceptable to AHJ
 - .2 Provide MSR products meeting stress design requirements indicated in the NBC that are grade marked by accredited agencies of the Canadian Lumber Standards Accreditation Board and conform to National Grading Rules published by the NLGA.
- .4 Structural Performance Requirements:
 - .1 Design shop-fabricated structural wood component connections to allow for building movements without damage or over-stressing; connection failures; and without imparting undue strain on fasteners and anchors.
 - .2 Account for the following structural performance requirements:
 - .1 Dead Loads: As indicated on Drawings
 - .2 Live Loads: As indicated on Drawings
 - .3 Roof Loads: As indicated on Drawings
 - .4 Snow Loads: As indicated on Drawings
 - .5 Live Load Deflection Limit: L/360
 - .6 Total Load Deflection Limit: L/240

2.3 MATERIALS

- .1 Laminated Veneer Lumber (LVL): Structural composite lumber comprised of laminated veneers glued together using manufacturer's proprietary waterproof adhesives and bonded under pressure and heat to provide design stresses based on 100% load duration and with the following properties:
 - .1 Grade: As scheduled on Drawings
 - .2 Dimensions: As scheduled on Drawings
- .2 Laminated Strand Lumber (LSL): Structural composite lumber comprised of laminated strands oriented along length of members glued together using manufacturer's proprietary waterproof adhesives and bonded under pressure and heat to provide design stresses based on 100% load duration, and with the following properties:
 - .1 Grade: As scheduled on Drawings
 - .2 Dimensions: As scheduled on Drawings
- .3 Parallel Strand Lumber (PSL): Large section structural composite lumber comprised of laminated strands oriented along length of members glued together using manufacturer's proprietary waterproof adhesives and bonded under pressure and heat to provide design stresses based on 100% load duration, and with the following properties:
 - .1 Grade: As scheduled on Drawings

- .2 Dimensions: As scheduled on Drawings
- .4 Prefabricated Wood I-Joists: Structural member fabricated in accordance with ASTM D5055, comprised of sawn or structural composite lumber flanges and structural composite panel webs bonded using manufacturer's proprietary waterproof adhesives to form an I-cross sectional shape with the following properties:
 - .1 Type: Commercial, meeting requirements of APA PRI-405
 - .2 Flange Stock: Sawn-lumber or structural composite lumber as standard with manufacturer.
 - .3 Web Material: Structural composite lumber as standard with manufacturer.
 - .4 Dimensions: As scheduled on Drawings

2.4 FABRICATION

- .1 Fabricated Structural Wood:
 - .1 Fabricate structural composite lumber and composite wood joists in accordance with the Drawings and Specifications, and the reviewed shop drawings.
 - .2 Mark all members for identification; mark top surface of straight beams clearly.
 - .3 Do not splice or join members in locations other than those shown on the Drawings.
 - .4 Apply specified sealer to exposed areas of structural composite lumber after fabrication; double treat exposed ends of laminates.
 - .5 Fasten plies of engineered lumber by nailing, screwing or through bolting as recommended by manufacturer; additional fasteners may be required to correct cupping and crowing of plies in built-up members.

2.5 ACCESSORIES

- .1 Sheathing: Provide wall, floor and roof sheathing as specified in Section 06 10 00 – Rough Carpentry and as scheduled on Drawings.
- .2 Wood Framing and Blocking: Provide sawn lumber materials as specified in Section 06 10 00 – Rough Carpentry.
- .3 Rim Boards: Structural composite lumber with a moisture protection coating, meeting requirements of APA PRR-401 for performance rated rim boards, and manufactured in accordance with ASTM D5456.
- .4 Ancillary Wood Components: Provide permanent bridging and bracing; headers and support framing at openings, and sheathing supports; blocking panels and other framing accessories required for complete and functional installation in accordance with manufacturer's written installation requirements.
- .5 Prefabricated Metal Anchoring Systems, Framing Connectors and Hangers: Prefabricated, pre-engineered hot-dipped zinc coated steel products tested or

- designed in accordance with CSA O86; types and configurations as indicated on Drawings.
- .6 Pre-Engineered Shear Plate Connections: Pre-manufactured, pre-engineered components designed in accordance with CSA O86; and as follows:
 - .1 Pressed Steel Type: Fabricated from hot rolled carbon steel shapes, plates and bars, meeting requirements of ASTM A36/A36M.
 - .7 Driven Fasteners: Steel nails, spikes, brads, and staples meeting requirements of ASTM F1667 or CSA B111:
 - .1 Ensure length is sufficient to penetrate connecting solid wood materials.
 - .2 Exterior Work: Hot-dipped galvanized.
 - .3 Interior High Humidity Work: Hot-dipped galvanized.
 - .4 Interior Work: Electroplated zinc plated, or cadmium plated.
 - .8 Rough Hardware – manufacturer recommended fastening devices and anchors, including bolts, nuts, drift pins, and washers meeting requirements of ASTM A307:
 - .1 Exterior Work: Hot-dipped galvanized in accordance with ASTM A153/A153M, Class C or D depending on diameter.
 - .2 Interior Work: Electroplated zinc coating, or cadmium plated.
 - .9 Wood Screws – use steel screws meeting requirements of ASME B18.6.1:
 - .1 Exterior Work: Galvanized, ceramic coated or stainless steel.
 - .2 Interior Work: Galvanized.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are acceptable for installation of structural composite lumber in accordance with manufacturer's written instructions and as follows:
 - .1 Report any discrepancies to the DCC Representative immediately upon discovery.
- .2 Proceed with installation of shop-fabricated structural wood laminated components after unacceptable conditions are corrected.

3.2 PREPARATION

- .1 Protection Before Installation: Protect shop-applied protective sealers, finishes and wrapping materials from damage before installation; touch up damaged finishes in accordance with manufacturer's written instructions.
- .2 Notification: Notify DCC Representative a minimum of 48 hours before installing any structural composite lumber units to allow for site review.

3.3 INSTALLATION

- .1 Install shop-fabricated structural lumber in accordance with reviewed shop drawings and manufacturer's written instructions.
- .2 Erection Aids:
 - .1 Securely brace shop-fabricated structural lumber components during construction; anchored to the ground, foundation, a braced wall or other completed, stable section of the structure.
 - .2 Remove temporary bracing as sheathing is attached, use caution to ensure that installed components remain stable.
 - .3 Support members laterally at end bearings and cantilevers.
- .3 Site Modifications: Structural composite lumber that requires notching, cutting or drilling arising from site conditions and that does not meet manufacturer's standard details must be performed in accordance with manufacturer's written recommendations, as directed by the DCC Representative. The following modifications will not be permitted:
 - .1 Holes spaced closer to supports than recommended by manufacturer.
 - .2 Cut holes that are larger than recommended by manufacturer.
 - .3 Hole locations spaced differently than recommended by manufacturer.
 - .4 Going through bolts, or using nails or screws not recommended by the manufacturer to fasten composite or built-up members.
- .4 Damaged Components: Do not use structural composite lumber components that exhibit visible damage; damaged components will require replacement with material of same quality and performance as specified Products.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry

1.2 SUMMARY

- .1 This Section includes requirements for supply and installation of shop-fabricated wood trusses using light-gauge metal connection plates and truss accessories required for a complete structural system with the following components:
 - .1 Roof ,Floor and Girder Trusses.
 - .2 Pre-engineered, pre-fabricated connectors and fastenings.
 - .3 Accessories, blocking, and other components required for complete installation.

1.3 REFERENCE STANDARDS

- .1 ASTM International (ASTM):
 - .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 A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
 - .3 ASTM F1667-18a, Standard Specification for Driven Fasteners: Nails, Spikes and Staples
- .2 CSA Group (CSA)
 - .1 CSA B111-1974 Wire Nails, Spikes and Staples
 - .2 CSA O86:19, Engineering Design in Wood
 - .3 CSA S347-14, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
 - .4 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada (NBC) 2020
 - .2 Canadian Construction Materials Centre (CCMC), Registry of Product Evaluations
- .4 Truss Plate Institute of Canada (TPIC)
 - .1 BCSI Canada 2014, Building Component Safety Information Book, Guide to Good Practice for Handling, Installing, Restraining and Bracing of Metal Plate Connected Wood Trusses
 - .2 TPIC - 2019, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Construction Meeting: Conduct a pre-construction meeting a minimum of two (2) weeks before starting work of this Section in accordance with Section 01 31 19 – Project Meetings, attended by Subcontractor, truss fabricator, other affected subcontractors, and DCC Representative to discuss the following:
 - .1 Verify project requirements.
 - .2 Review installation conditions.
 - .3 Coordinate with building subcontractors affected by work of this Section.
 - .4 Review truss fabricator's written product handling and installation instruction requirements.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals (to be provided before starting any work of this Section):
 - .1 Product Data:
 - .1 Submit truss fabricator's installation instructions, special handling criteria, installation sequence, and printed product literature and data sheets describing product characteristics, performance criteria, physical size, finish and limitations of hardware components required for installation.
 - .2 Shop Drawings: Prepare and submit shop drawings in accordance with the Truss Plate Institute of Canada (TPIC) Truss Design Drawing requirements indicating connection details, erection sequence, framing details and the following:
 - .1 Special Requirements: Identify special structural modifiers (if any) that may be required by local AHJ.
 - .2 Wood Truss Drawings: Indicate applicable TPIC Truss Design Procedures and CSA O86 engineering requirements, including the following:
 - .1 Name of truss fabricator and truss plate manufacturer.
 - .2 Truss identification number and job name.
 - .3 Wood species, sizes, and stress grades of lumber used as truss members.
 - .4 Pitch, span, camber, configuration and spacing of trusses.
 - .5 Required bearing widths and bearing details.
 - .6 Specified loads applicable to:
 - .1 Top chord live load.
 - .2 Top chord dead load.
 - .3 Bottom chord live load.
 - .4 Bottom chord dead load.
 - .5 Concentrated loads and their points of application.
 - .6 Methods for controlling unbalanced loads.

- .7 Wind and earthquake loads used for design solution.
- .7 Connector types, thicknesses, sizes, locations, and design values.
- .8 Location, size and fastening of required permanent truss member bracing.
- .9 Connection requirements for truss to truss, truss to girder, truss to bearing, and site fabricated splices.
- .10 Reaction forces and point load locations, when different than heel locations, indicating points of occurrence and direction.
- .11 Locations of the maximum deflection and movements under live load conditions indicated on Drawings.
- .12 Allowable lateral horizontal movement of trusses under live load conditions indicated on Drawings.
- .13 Design loads for members.
- .14 Bearing length for trusses accounting for maximum deflected shape and horizontal slip at bearing ends of each member.
- .15 Location of lateral bracing for compression members.
- .16 Additional information used for confirmation of truss design.
- .3 Indicate stress diagram or print out of computer design indicating design load for truss members - include allowable load and stress increase.
- .4 Indicate arrangement of webs or other members to accommodate ducts and other specialties.
- .5 Indicate adjustments to lumber and connector plate design values based on conditions of use (if any).
- .6 Indicate connector plate types, thickness, size and location at each joint, except where symmetrical configurations allow for centreline illustration of joints.
- .7 Indicate connection requirements for truss to bearing, truss or girder ply to ply and site-assembled splices.
- .8 Indicate end connections of trusses to resist uplift and lateral reactions.
- .9 Supporting professional engineer registered or licensed in Ontario, Canada, is required to seal and sign design solutions presented in submitted shop drawings prepared under their supervision.
- .1 Refer to Section 01 35 73 – Delegated Design.
- .3 Placement Drawings: Submit placement and layout drawings for review by DCC Representative including the following:
 - .1 Submit Placement Drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.

- .2 Indicate sequence of installation and erection, and temporary bracing requirements.
 - .3 Label truss and girder layouts using the same identification numbers indicated on shop drawings described in Subparagraph 1.6.2.2 above.
 - .4 Indicate partitions being used as bearing walls.
 - .5 Indicate hanger type used for connecting trusses to girder trusses and beams.
 - .6 Indicate connection requirements for truss to bearing, truss or girder ply to ply and site-assembled splices when not indicated on shop drawings described in Subparagraph 1.6.2.2 above.
- .3 Informational Submittals: Provide the following submittals concurrently with Action Submittals described above:
- .1 Qualification Data: Submit concurrently with shop drawings proof of qualifications for truss fabricator and materials proposed for use as described in Article 1.7, Quality Assurance below.
 - .2 Certificates: Submit certificates signed by truss fabricator indicating that Products supplied to the Project meet requirements of TPIC Truss Design Procedures.
 - .3 Source Quality Control Submittals: Submit test reports for shop-fabricated wood trusses signed by supporting professional engineer registered or licensed in Ontario, Canada , or other independent testing agency acceptable to DCC Representative indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Sustainable Design Submittals: provide information supporting PART 2 – Sustainability Characteristics described in this Section.

1.6 QUALITY ASSURANCE

- .1 Qualifications: When requested by DCC Representative, provide proof of qualifications as described in Article 1.6, Submittals.
- .1 Truss Fabricators: Obtain shop-fabricated structural wood trusses and accessories from a single fabrication source qualified in accordance with CWTA National Quality Standard that can provide evidence of In-Plant Qualification Program recognized by regional wood truss associations or other proof of manufacturing and design capability acceptable to the DCC Representative.
 - .2 Truss Plate Manufacturer: Provide evidence that plates used for truss manufacturing are manufactured to meet testing requirements of CSA S347, and are listed in the Registry of Product Evaluations published by Canadian Construction Materials Centre (CCMC), or other proof of manufacturing capability acceptable to the DCC Representative.
 - .3 Welded Connection Fabricator: Provide welded connections fabricated in a shop certified by CWB to CSA W47.1, Division 1 or 2.1.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: Deliver, handle, store and protect materials in accordance with truss fabricator's written instructions, and in accordance with BCSI Canada.
- .2 Storage and Handling Requirements:
 - .1 Provide bearing supports and bracings to prevent bending, warping and overturning of trusses, in accordance with truss fabricator's written instructions and in accordance with BCSI Canada.
 - .2 Store and protect materials from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the truss fabricator.
 - .3 Keep materials dry.
 - .4 Store trusses on hard, dry and level surface.
 - .5 Do not store truss lumber in direct contact with ground.
 - .6 Do not expose trusses to prolonged weather exposure.

1.8 SITE CONDITIONS

- .1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where shop-fabricated wood trusses are indicated to fit between or around other construction. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Dimensions: Establish dimensions and proceed with fabricating shop-fabricated wood trusses without site measurements where site measurements cannot be made without delaying the Work. Coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 DESCRIPTION

- .1 Regulatory Requirements: Fabricate trusses, bracing and bridging in accordance with CSA O86 using truss joint components tested in accordance with CSA S347, and using products bearing accredited stamp with the manufacturer's name and certificate number, grade, CCMC certificate number (if applicable) and quality control agency.
 - .1 Qualification Markings: Apply CWTA Plant Qualification marking or tag or other plant certification agency accredited by the Standards Council of Canada to each truss assembly in a readily visible location.
 - .2 Loading: Design trusses to account for minimum uniform and minimum concentrated loadings stipulated in NBC commentary applicable to metal plate connected wood trusses.
 - .3 Loading Markings: Apply additional special markings at point load locations other than truss heels on each truss, and on bottom chord of bottom bearing, parallel chord trusses.

- .2 Lumber Grades: Provide lumber products that are all sides finished (S4S) in nominal dimensions required for the project; grade marked by accredited agencies of the Canadian Lumber Standards Accreditation Board and that conform to National Grading Rules published by NLGA.
 - .1 Grading: Machine Grading, Visual Grading, or Both.
 - .2 Moisture Content: Kiln Dry, 19% or less.
 - .3 Structural Design Properties: Strength and related properties in accordance with CSA O86 and NLGA SPS 2.

2.2 DESIGN CRITERIA

- .1 Design Responsibility: Truss fabricator is required to retain a supporting professional engineer registered or licensed in Ontario, Canada, experienced in the design and detailing of light metal plate connected wood trusses in accordance with TPIC Truss Design Procedures using engineering properties listed in CSA O86 for components described in this Section, and as follows:
 - .1 Loads and forces shown on Drawings are not factored, unless specifically indicated otherwise.
 - .2 Request any loads and forces not shown on Drawings from DCC Representative, and that are required by the supporting professional engineer registered or licensed in Ontario, Canada, to complete design and detailing of connections.
 - .3 The supporting professional engineer will provide the following in accordance with governing standards described in this Section:
 - .4 Design of wood truss members for Serviceability Limit States described in TPIC Truss Design Procedures, and as indicated on Drawings.
 - .5 Design and detailing of wood truss members, bracing and bridging based on design loading and spacing indicated on Drawings.
 - .6 Design and detailing of connections not specifically detailed on the Drawings.
 - .7 Details of dimensions to accommodate mechanical services passing through truss members indicated on Drawings.
 - .8 Written confirmation that components are fabricated in accordance to shop drawings submitted for the DCC Representative's review.
- .2 Structural Performance Requirements: Design shop-fabricated structural wood component connections to allow for building movements without damage or over stressing, connection failures, and imparting undue strain on fasteners and anchors. Also take into account the following structural performance requirements:
 - .1 Wet Service Conditions Modifier: Not Required.
 - .2 Dead Loads: Dead loads as indicated on Drawings.
 - .3 Live Loads: Live loads as indicated on Drawings.
 - .4 Roof Loads: Roof loads as indicated on Drawings.
 - .5 Snow Loads: Snow loads as indicated on Drawings.

- .6 Exterior Wind Loads: Wind loads q_{50} for deflection and for strength, modified by importance factors, building exposure, gust effect factors, and pressure coefficients in accordance with structural commentaries and also accounting for the following:
 - .1 Wind Design Data: Location specific data from the NBC.
- .7 Live Load Deflection Limit: $L/360$.
- .3 Design Tolerances: Design trusses with positive camber to allow for calculated deflection under dead and live loads to planar profile along slope or level top chord appropriate to truss type; limit horizontal deflection at reaction points to a maximum of 32 mm.
- .4 Modifications to Design: Supporting professional engineer registered or licensed in Ontario, Canada is required to account for changes to dimension and bearing capacities inherent with their Products where they are used to establish the Bid Price, while keeping in mind the following:
 - .1 Changes to placement of girder trusses and other loadbearing elements indicated on Drawings will not be permitted without before the acceptance from the DCC Representative.
 - .2 Changes that modify design criteria described by the DCC Representative will not be permitted without before the acceptance from the DCC Representative.
 - .3 No adjustment to contract price will be considered where manufactured or fabricated component sizes must change to account for design loads indicated on Drawings.
 - .4 Design changes and associated questions will not be considered during the procurement / tender stage of the project.

2.3 MATERIALS

- .1 Truss Framing: Provide wood materials meeting truss fabricator's design requirements and meeting Structural Performance Requirements listed above.
- .2 Truss Plates: Provide truss plates meeting requirements of CSA S347, manufactured from galvanized steel sheet meeting requirements of ASTM A653/A653M, having zinc coating designation Z275, and as follows:
 - .1 Grade: Structural steel sheet or high strength, low alloy steel sheet as determined by truss fabricator's supporting professional engineer registered or licensed in Ontario, Canada, based on loads and use conditions identified by DCC Representative.
 - .2 Truss Anchors and Hangers: Provide truss anchors and hangers meeting requirements of CSA O86, manufactured from galvanized steel sheet meeting requirements of ASTM A653/A653M, having zinc coating designation Z275.
- .3 Wood Framing and Blocking: Provide sawn lumber materials as specified in Section 06 10 00 – Rough Carpentry.

- .4 Driven Fasteners: Steel nails, spikes, brads, and staples meeting requirements of ASTM F1667 or CSA B111. Ensure length is sufficient to penetrate connecting solid wood materials.
 - .1 Exterior Work: Hot-dipped galvanized.
 - .2 Interior High Humidity Work: Hot-dipped galvanized.
 - .3 Interior Work: Electroplated zinc plated, or cadmium plated.

2.4 FABRICATION

- .1 Fabricate wood trusses based on the reviewed shop drawings that were created in accordance with TPIC Truss Design Procedures at an accredited truss plant participating in CWTA In-Plant Qualification Program and with the following:
 - .1 Assemble truss members in design configuration required for project.
 - .2 Assemble truss members using jigs or other means to maintain uniformity and accuracy of assembly with joints closely fitted to meet tolerances listed by TPIC Truss Design Procedures.
 - .3 Account for design camber and roof slopes when positioning truss members.

2.5 SOURCE QUALITY CONTROL

- .1 In-Plant Testing and Inspections:
 - .1 Test a minimum of three (3) trusses of each type as described in CWTA In-Plant Qualification Program and submit a report indicating that tested trusses represent trusses used for the Project.
 - .2 Indicate any manufacturing and material variances described in Appendix G of TPIC Truss Design Procedures.
 - .3 Conduct in plant testing and inspections in accordance with CSA S347.
 - .4 Document any follow-up repairs, rework or replacement of trusses for non conforming materials or variances in workmanship.
 - .5 Supporting professional engineer registered or licensed in Ontario, Canada, will direct all follow up repairs and rework and validate that trusses delivered to the Project meet specified requirements.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of 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 PREPARATION

- .1 Concentrated Load Prevention: Prevent concentrated loads on trusses until required bracing and sheathing is installed; do not permit stacking of sheathing bundles, lumber and other materials on unsheathed trusses.

3.3 ERECTION

- .1 Installation Requirements:
 - .1 Erect wood trusses in accordance with reviewed shop drawings, fabricator's written instructions, and in accordance with BCSI Canada.
 - .2 Make adequate provisions for handling and erection stresses.
 - .3 Exercise care to prevent out-of-plane bending of trusses.
 - .4 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.
 - .5 Install permanent bracing, bridging and sheathing in accordance with reviewed shop drawings, before the application of loads to trusses.
 - .6 Do not cut or remove any truss component without written confirmation by DCC Representative, and supporting professional engineer registered or licensed in Ontario, Canada.
- .2 Bracing Requirements:
 - .1 Install permanent lateral bracing as indicated on shop drawings, in size and grade described, and fastened at locations shown using number and size of nails described on truss shop drawings.
 - .2 Restrain lateral movement of bracing using permanently installed cross bracing at ends of each truss run and evenly spaced at intervals of six (6) metres or less.
 - .3 Restrain top chord of trusses to prevent lateral movement using sheathing or permanent bracing as indicated on shop drawings.
 - .4 Install lateral ties evenly spaced at intervals of three (3) metres or less; with additional permanent lateral bracing as indicated on shop drawings.
- .3 Site Modifications: Cutting, notching, or drilling of shop-fabricated wood trusses arising from site conditions that do not meet fabricator's standard details will not be permitted without fabricator's written recommendations, as directed by the DCC Representative.
- .4 Damaged Components:
 - .1 Do not use shop-fabricated wood truss components that exhibit visible damage; damaged components will require replacement with material of same quality and performance as specified Products.
 - .2 Notify DCC Representative and supporting professional engineer immediately of any damage to wood truss components.
 - .3 Supporting professional engineer registered or licensed in Ontario, Canada, will recommend repair or replacement procedures as directed by the DCC Representative.

- .4 No work for repair or replacement of damaged components will be permitted without DCC Representative's written instructions.

3.4 SITE QUALITY CONTROL

- .1 Truss Fabricator's Site Services: Truss fabricator's supporting professional engineer registered or licensed in Ontario, Canada, will review completed construction to verify that installation of wood truss system is in accordance with shop drawings and placement drawings. Other site services include:
 - .1 Review products supplied under this Section and confirm that wood truss system handling, installation and erection, protection and cleaning of its products is in accordance with fabricator's written instructions.
 - .2 Truss fabricator's site services and recommendations include product use recommendations and periodic site visits for inspection of product installation in accordance with truss fabricator's instructions.
 - .3 Submit written reports in format acceptable to DCC Representative, to verify compliance of Work with Contract.

3.5 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.6 CLOSEOUT ACTIVITIES

- .1 Non-Conforming Work: DCC Representative will confirm correction and verification procedures with manufacturer and instruct Subcontractor responsible for work of this Section on repair procedures or replacement of non-conforming work.
- .2 Adjusting: Repair damage to adjacent materials caused by installation of materials specified in this Section.
- .3 Repairs:
 - .1 Replace wood trusses that are damaged or do not meet requirements.
 - .2 Apply touch-up coating materials to provide minimum dry film thickness recommended by coating system manufacturer.
 - .3 Repair damaged galvanized coatings on exposed surfaces with galvanized repair coating in accordance with ASTM A780/A780M and truss plate manufacturer's written instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
 - .1 North American Architectural Woodwork Standards, v 4.0, 2021, including Errata
- .2 ASTM International:
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .2 ASTM F1667-18a, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .3 Builders Hardware Manufacturers Association (BHMA):
 - .1 ANSI/BHMA A156.9-2020, Cabinet Hardware
- .4 CSA Group:
 - .1 CSA O141:05, Softwood Lumber
- .5 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber 2017

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate on shop drawings, materials, component profiles, fastening methods, jointing details, finishes, accessories, and to minimum scale of 1:8.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Protect materials against dampness during and after delivery.
- .3 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.

Part 2 Products

2.1 LUMBER MATERIAL

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 19 % or less for finish carpentry materials in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC custom grade, moisture content as specified.
- .2 Softwood and hardwood lumber: Sound lumber to specified AWS grade requirements, kiln-dried to moisture content recommended for location of the Work.
 - .1 Machine stress-rated lumber is acceptable for all purposes.

2.2 TRIM

- .1 Interior baseboard: 19 mm thick x 100 mm height, prime-painted pine, paint finish.
- .2 Interior door and window trim: 13 mm thick x 75 mm, prime-painted pine, paint finish.
- .3 Headers: install over window and door openings. Trim materials to be of similar styles to new baseboard and casing. prime-painted pine, paint finish.
- .4 Pre-cut and pre-finish prime-painted pine trims.

2.3 HARDWARE

- .1 Closet rods: To ANSI/BHMA A156.9, heavy duty round steel tubing, polished chrome finish.
 - .1 Outside diameter: Minimum 27 mm.
 - .2 Wall thickness: Minimum 2.2 mm.
 - .3 Mounting brackets: Round closed flange, three-screw attachment.
 - .4 Provide center supports for closet rods longer than 1.5 m (5 feet).
- .2 Wire shelving: Grade C-1006 cold drawn steel wire, with white PVC coating or enamel paint finish, fixed mounting.
 - .1 Depth: 500 mm (20 inches).
 - .2 Cross deck wire thickness: 12-3/4 gauge.
 - .3 Cross deck wire spacing: maximum 25 mm (1 inch).
 - .4 Provide hardware as required for complete installation, including screws, clips, support brackets, connectors, anchors, and end caps.

2.4 ACCESSORIES

- .1 Nails and staples: to ASTM F1667; galvanized to ASTM A123/A123M, for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .2 Wood screws: electroplated, except stainless steel in humid areas, type and size to suit application.
- .3 Splines: wood plastic metal.
- .4 Adhesive: recommended by manufacturer.
- .5 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this section.

Part 3 Execution

3.1 INSTALLATION

- .1 Perform finish carpentry to Custom Grade, Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .3 Install finish carpentry and accessories straight, level, and plumb.
- .4 Form joints to conceal shrinkage.

3.2 CONSTRUCTION

- .1 Fastening:
 - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
 - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
 - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
 - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Standing and running trim:
 - .1 Install with nails at 200 mm on center.
 - .2 Butt and cope internal joints of casework to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.

- .3 Fit backs of baseboards snugly to wall surfaces to eliminate cracks at junction of base with walls.
- .4 Make joints in baseboard, where necessary using a 45° scarf joint.
- .3 Hardware:
 - .1 Install hardware items as indicated, fasten to solid backing or blocking with screws.

3.3 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI A135.4-2020, Basic Hardboard
 - .2 ANSI A208.1-2009, Particleboard
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
 - .1 North American Architectural Woodwork Standards, v. 4.0, 2021, including Errata
- .3 ASTM International:
 - .1 ASTM F1667-18a, Standard Specification for Driven Fastener: Nails, Spikes, and Staples
- .4 Composite Panel Association (CPA):
 - .1 CPA/ANSI A208.2-2022, Medium Density Fiberboard (MDF) for Interior Applications
- .5 CSA Group:
 - .1 CSA O141:05, Softwood Lumber
 - .2 CSA O151-17, Canadian Softwood Plywood
- .6 Hardwood Plywood Veneer Association (HPVA):
 - .1 ANSI/HPVA HP-1-2020, Hardwood and Decorative Plywood
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .8 National Electrical Manufacturers Association (NEMA):
 - .1 ANSI/NEMA LD3-2005, High-Pressure Decorative Laminates
- .9 National Hardwood Lumber Association (NHLA):
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress, 2023
- .10 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber, 2017

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 architectural woodwork; include product characteristics, performance criteria, physical sizes, finishes, and limitations.
 - .1 Submit WHMIS Safety Data Sheets (SDS) used in the project.
 - .1 Adhesives.
 - .2 Sealants.
- .3 Shop Drawings:
 - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .1 Scales: profiles full size, details half full size.
 - .2 Indicate materials, thicknesses, finishes and hardware.
 - .3 Indicate locations of service outlets in casework, typical and special installation conditions, connections, attachments, anchorage, and location of exposed fastenings.
- .4 Samples:
 - .1 Submit duplicate samples of hardwood, sized 200 x 200 mm, or 300 mm long.
 - .2 Submit duplicate manufacturer's samples of high-pressure decorative laminate.
- .5 Certifications: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, and wood based composite panels to CSA and NPA standards.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .3 Protect millwork against dampness and damage during and after delivery.
- .4 Storage and Handling Requirements:
 - .1 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.
 - .2 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry area.

- .3 Store and protect products from damage.
- .4 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Softwood lumber: Unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC Custom grade, moisture content as specified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC Custom grade, moisture content as specified.
- .4 Canadian softwood plywood (CSP): To CSA O151, standard construction.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .5 Hardwood plywood: to ANSI/HPVA HP-1.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .6 Wood veneer: To AWMAC requirements.
 - .1 Species: Maple.
 - .2 Cut: Quarter.
 - .3 Grade: A.
- .7 Hardboard: To ANSI A135.4, Tempered.
 - .1 Hardboard resin to contain no added urea-formaldehyde.
- .8 Particleboard core: To ANSI A208.1, Grade M2 or better.
- .9 MDF (medium density fibreboard) core: To CPA/ANSI A208.2, Grade 130 or better.
 - .1 MDF resin to contain no added urea-formaldehyde.
- .10 Moisture-resistant MDF: To CPA/ANSI A208.2, Grade 155 MR50.
- .11 High pressure decorative laminate (HPDL) for horizontal surfaces: To NEMA LD3, Horizontal Grade Standard (HGS), 1.2 ± 0.12 mm thick.
- .12 HPDL for vertical surfaces: To NEMA LD3, Vertical Grade Standard (VGS), $0.7 \text{ mm} \pm 0.10 \text{ mm}$ thick.
- .13 HPDL for postforming work: To NEMA LD3, Horizontal Grade Postforming (HGP), 1.0 ± 0.12 mm thick.

- .14 Laminate liner sheet: Grade CLS, 0.5 ± 0.10 mm thick, white colour.
- .15 Laminate backing sheet: Grade BKL, minimum 0.5 mm thickness.
- .16 Laminate adhesive: Contact adhesive, polychloroprene or neoprene, clear curing.
- .17 Nails and staples: To ASTM F1667.
- .18 Wood screws: Stainless steel; type and size to suit application.
- .19 Splines: Metal.
- .20 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

2.2 MANUFACTURED UNITS

- .1 Fabricate casework to AWMAC Custom Grade.
- .2 Casework:
 - .1 Design cabinets without unusable space and blind corners.
- .3 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
 - .1 S2S is acceptable.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
- .4 Framing: Maple species, construction select grade. Case bodies (ends, divisions, bottoms). Visible exteriors of cabinets wood veneer, finished to match doors.
 - .1 Hardwood plywood:
 - .1 Thickness: minimum 16 mm plywood veneer core of appropriate grade for exposed and semi-exposed areas.
 - .2 Number of plies: 7.
 - .3 Sanding: regular sanding.
 - .4 Grain direction vertical.
 - .5 Finish: clear polyurethane.
- .5 Backs: Maple plywood good one side, appropriate thickness for method in construction.
 - .1 Finish: clear polyurethane.
- .6 Shelving: adjustable, shelf clips and bore holes, spaced +/- 32 mm on centre.
 - .1 Material: 19 mm MDF
 - .2 Finish: Melamine, all 6 sides
- .7 Drawers:
 - .1 Sides and back: 16 mm Maple plywood, sanded and finished with same products as case work components.
 - .2 Acceptable method of assembly: multiple dovetails or dowelled.
 - .3 Bottoms: 13 mm Maple plywood.

- .1 Finish: clear polyurethane.
- .8 Doors and Drawer Fronts:
 - .1 Shaker style.
 - .2 Door/drawer stiles and rails: Maple, with centre panel 6 mm Maple plywood good 2 sides.
 - .1 Finish: clear polyurethane.
- .9 Infill panels: to match adjacent door and front construction. Solid Wood / Wood Veneer over minimum 12mm Maple Plywood Substrate.
- .10 Gable Panels:
 - .1 Substrate: moisture resistant MDF, thickness as per drawings.
 - .2 Exposed Finished Surface: HPDL.
 - .3 Exposed Edges: HDPL
- .11 Laminate countertops (including vanity tops, desktops):
 - .1 Cores: moisture resistant MDF.
 - .2 Tops: HPDL.
 - .3 Bottoms: Laminate backer sheet.
 - .4 Back splashes: Butt joint.
 - .5 Exposed edges: post-formed.
- .12 Toe Kick Panels: to match adjacent door and front construction. Solid Wood / Wood Veneer over minimum 16mm Maple Plywood Substrate.

2.3 **HARDWARE**

- .1 Shelf supports:
 - .1 Shelf clips.
- .2 Drawer and Door Pulls: Contemporary solid steel type. Finish brushed nickel.
 - .1 Confirm proposed product with DCC Representative.
- .3 Hinges: standard, 110-degree swing for regular doors, 170-degree swing for non-angled corner cabinets, soft-closing, all-metal with three-way hinge arm adjustment, and mounting plate. All hinges to be Grade 1. Verify placement, quantity and quality requirements of hinges with manufacturer.
 - .1 Doors up to 810 mm high: 2 hinges.
 - .2 Doors between 810 and 1200 mm: 3 hinges.
 - .3 Doors over 1200 mm high: 4 hinges.
- .4 Integrated drawer glides, under-mount, full extension, soft close, 3-dimensional front adjustment, minimum weight capacity 40 kg (88lb).

2.4 FABRICATION

- .1 Set nails and countersink screws apply colour-matched wood filler to indentations, sand smooth, and leave ready to receive finish.
- .2 Shop-install cabinet hardware for doors, shelves, and drawers.
- .3 Shelving to cabinetwork to be adjustable.
- .4 Provide cut-outs for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .6 Obtain governing dimensions before fabricating items that are to accommodate or abut appliances, equipment, and other materials.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 Veneer laminate to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.
 - .1 Visually inspect substrates.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Perform architectural woodwork to Quality Standards of AWMAC, Custom Grade.
- .2 Install prefinished millwork at locations shown on drawings.
 - .1 Position accurately, level, plumb, and straight.
- .3 Fasten and anchor millwork securely.
 - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .4 Use draw bolts in countertop joints.
- .5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .6 At junction of laminate counter back splash and adjacent wall finish, apply small bead of silicone sealant in accordance with Section 07 92 00 - Joint Sealants.

- .7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.
- .8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
 - .1 Clean millwork outside surfaces, and inside cabinets and drawers.
 - .2 Remove excess glue from surfaces.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 PROTECTION

- .1 Protect millwork from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section includes all labour and materials required to complete mock-up installation including component review and testing and quality control/quality assurance testing on thermal and moisture protection systems.

1.2 RELATED SECTIONS

- .1 Section 07 13 52 - Modified Bituminous Sheet Waterproofing
- .2 Section 07 14 00 - Fluid - Applied Waterproofing
- .3 Section 07 21 13 - Board Insulation
- .4 Section 07 21 16 - Batt Insulation
- .5 Section 07 21 23 - Loose-Fill Insulation
- .6 Section 07 21 29 - Sprayed Insulation
- .7 Section 07 25 00 - Air and Vapour Barriers
- .8 Section 07 46 13 - Preformed Metal Siding
- .9 Section 07 54 00 - Thermoplastic Membrane
- .10 Section 07 61 00 - Sheet Metal Roofing
- .11 Section 07 62 00 - Sheet Metal Flashing and Trim
- .12 Section 07 92 00 - Joint Sealants

1.3 MEASUREMENT AND PAYMENT

- .1 Visual Reviews and Building Envelope Testing; by Third-Party Inspection and Testing Agency, hired by the Contractor.
- .2 Building Envelope Testing: by Building Envelope Commissioning Authority, hired by the Contractor.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C1521-19(2020) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

- .2 ASTM D4541-17 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- .3 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
- .4 ASTM E3158-18 - Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building
- .2 International Organization for Standardization (ISO):
 - .1 ISO 17025:2005, General requirements for the competence of testing and calibration laboratories

1.5 BUILDING ENVELOPE COMMISSIONING PRE-CONSTRUCTION CONFERENCE

- .1 Building Envelope Commissioning Pre-Construction Conference in accordance with General Requirements.
- .2 Convene Building Envelope Commissioning Pre-Construction conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Contractor, DCC Representative, Commissioning Authority, Building Envelope Commissioning Authority (hired by DCC Representative), Third-Party Inspection and Testing Agency and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review submittals and product data sheets for building envelope materials.
 - .3 Review installation and substrate conditions.
 - .4 Lead coordination between subtrades.
 - .5 Review manufacturer's installation instructions and warranty requirements.
 - .6 Review compatibility of materials and material overlap points.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all thermal and moisture protection components, shall

provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.

.4 Product Data

.1 Provide product data for:

- .1 Section 07 13 52 - Modified Bituminous Sheet Waterproofing
- .2 Section 07 14 00 - Fluid - Applied Waterproofing
- .3 Section 07 21 13 - Board Insulation
- .4 Section 07 21 16 - Batt Insulation
- .5 Section 07 21 23 - Loose-Fill Insulation
- .6 Section 07 21 29 - Sprayed Insulation
- .7 Section 07 25 00 - Air and Vapour Barriers
- .8 Section 07 46 13 - Preformed Metal Siding
- .9 Section 07 54 00 - Thermoplastic Membrane
- .10 Section 07 61 00 - Sheet Metal Roofing
- .11 Section 07 62 00 - Sheet Metal Flashing and Trim
- .12 Section 07 92 00 - Joint Sealants

.5 Shop Drawings

.1 Provide shop drawings for:

- .1 Section 07 46 13 - Preformed Metal Siding
- .2 Section 07 61 00 - Sheet Metal Roofing
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim

.6 Qualification Statements:

- .1 Submit proof of Third-Party Inspection and Testing Agency qualifications for review and acceptance:
 - .1 Proof of ISO 17025.

1.7 THIRD-PARTY INSPECTION AND TESTING AGENCY

.1 Third-Party Inspection and Testing Agency:

- .1 Third-party accredited testing laboratory hired by Contractor.
- .2 Accredited to ISO 17025.

1.8 QUALITY ASSURANCE

- .1 Notify the DCC Representative, Commissioning Authority, Building Envelope Commissioning Authority, and the Third-Party Inspection and Testing Agency in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor's work shall be carried out by the by the Third-Party Inspection and Testing Agency.

- .2 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or testing of thermal and moisture protection components:
 - .1 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the thermal and moisture protection components.
 - .2 Provide a minimum seventy-two (72) hours' notice for thermal and moisture protection components to be reviewed by Third-Party Inspection and Testing Agency.
 - .2 On-Site Quality Assurance Review and/or Testing
 - .1 Visual review and testing of the installed thermal and moisture protection components may be periodically completed at the discretion of the Third-Party Inspection and Testing Agency.
 - .2 Provide a minimum seventy-two (72) hours' notice for thermal and moisture protection components to be reviewed by Third-Party Inspection and Testing Agency.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- .1 Provide a mock-up of the modified bituminous sheet waterproofing at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.
- .3 Adhesion testing:
 - .1 Adhesion testing shall be completed by the Third-Party Inspection and Testing Agency in accordance with ASTM D4541, using a 2.25" diameter disk.

- .2 Standard of acceptance shall be the mean minus one standard deviation calculated from the mock-up and compared to manufacturer's requirements, but not less than 15 psi. In the event of a deficit, the manufacturer shall be consulted for direction.
- .3 Pull tests shall be completed in sets of three per each substrate type, at the discretion of the Third-Party Inspection and Testing Agency.
- .4 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Four (4) times during remainder of installation.
- .4 Air- leakage testing:
 - .1 Air leakage testing shall be completed by the Third-Party Inspection and Testing Agency at membrane seams and overlaps and at the cladding support system anchorage penetrations in accordance with ASTM E1186.
 - .2 Standard of acceptance is no observable air leakage.
 - .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Four (4) times during remainder of installation.

3.2 THERMAL INSULATION

- .1 Provide mock-ups of thermal insulation at locations identified by the Third-Party Inspection and Testing Agency prior to full system installation. Mock-ups to be provided for each type of thermal insulation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.3 AIR AND VAPOUR BARRIERS

- .1 Provide mock-ups of the air and vapour barriers at locations identified by the Third-Party Inspection and Testing Agency prior to full system installation. Mock-ups to be provided for each combination of membrane and substrate.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:

- .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.
- .3 Adhesion testing:
 - .1 Adhesion testing shall be completed by the Third-Party Inspection and Testing Agency in accordance with ASTM D4541, using a 2.25" diameter disk.
 - .2 Standard of acceptance shall be the mean minus one standard deviation calculated from the mock-up and compared to manufacturer's requirements, but not less than 15 psi. In the event of a deficit, the manufacturer shall be consulted for direction.
 - .3 Pull tests shall be completed in sets of three per each substrate type.
 - .4 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Four (4) times during remainder of installation.
- .4 Air- leakage testing:
 - .1 Air leakage testing shall be completed by the Third-Party Inspection and Testing Agency at membrane seams and overlaps and at the cladding support system anchorage penetrations in accordance with ASTM E1186.
 - .2 Standard of acceptance is no observable air leakage.
 - .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Four (4) times during remainder of installation.

3.4 PREFORMED METAL SIDING

- .1 Provide a mock-up of the preformed metal siding at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.5 THERMOPLASTIC MEMBRANE

- .1 Provide a mock-up of the thermoplastic membrane at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.

- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.6 SHEET METAL ROOFING

- .1 Provide a mock-up of the sheet metal roofing at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.7 SHEET METAL FLASHING AND TRIM

- .1 Provide a mock-up of the sheet metal flashing and trim at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.8 JOINT SEALANTS

- .1 Provide mock-ups of the typical joints (control joints, transition joints, window rough openings, etc.), at locations identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:

- .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
- .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.
- .3 Adhesion testing:
 - .1 Adhesion testing on fully cured joints shall be completed by the Third-Party Inspection and Testing Agency in accordance with ASTM C1521, Destructive Procedure Method A.
 - .2 Adhesion testing on fully cured joints at dissimilar substrates shall be completed by the Third-Party Inspection and Testing Agency in accordance with ASTM C1521, Flap Procedure.
 - .3 Standard of acceptance shall be in accordance with manufacturer's published data and as follows:
 - .1 Silicone Sealants:
 - .1 Sealant should tear cohesively within itself or elongate the 1" gauge length the extent specified in the product manufacturer's technical literature before releasing from either substrate adhesively.
 - .2 Urethane Sealants:
 - .1 Sealant should tear cohesively within itself without bond loss.
 - .4 At this time, the joint will be reviewed for complete fill. The joint should not have voids, and joint dimensions should match those shown on the drawings.
 - .5 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Four (4) times during remainder of installation.

3.9 WHOLE BUILDING AIR TIGHTNESS TESTING

- .1 Whole building air tightness testing shall be completed by the Third-Party Inspection and Testing Agency in general accordance with ASTM E3158. Testing will occur at major construction milestones as determined by the DCC Representative.
 - .1 Building shall be under positive pressurization to minimum 50Pa, or as otherwise directed by DCC Representative.
 - .2 Pressurization to be achieved through blower door apparatus.
 - .3 Testing shall be completed for "Building Envelope" (HVAC related openings excluded) configuration as per ASTM E3158.

- .4 Standard of acceptance shall be meeting the Air Leakage Target by DCC Representative.
 - .1 Air Leakage Target:
 - .1 0.8 ACH at 50 Pa (21 L/s/m²), or as otherwise directed by DCC Representative.
- .5 In the event of a deficit, leakage areas to be identified by smoke trace and to be remediated by the Contractor at the direction of the DCC Representative.
- .2 Frequency of Testing:
 - .1 Rough-in Phase: Installation of whole building air barrier, exterior windows and doors, ceiling and roof barrier, and sealing of all through wall penetrations, has been completed.
 - .2 Pre-finishes Phase: Installation of mechanical/electrical equipment rough-ins, vapour barrier, and exterior insulation, and flashings have been completed.
 - .3 Pre-substantial Phase: Installation of boarding and taping, exterior cladding, HVAC systems installed and operational.
- .3 Contractor to co-ordinate whole building air tightness test to coincide with the thermographic scan occurring at both pre-finishes phase and pre-substantial phase.

3.10 THERMOGRAPHIC SCAN

- .1 Thermographic scan shall be completed by the Third Party Testing Agency in general accordance with ASTM E1186 prior to Substantial Completion.
 - .1 Minimum temperature differential shall be 20°C, or as otherwise directed by the DCC Representative.
 - .2 Building shall be under positive pressurization to 50Pa, or as otherwise directed by DCC Representative.
- .2 Contractor to co-ordinate, supervise, assist, and provide access for thermographic scan including coordination for mechanical system pressurization during the test.
- .3 Frequency of Testing:
 - .1 Pre-finishes Phase: Installation of mechanical/electrical equipment rough-ins, vapour barrier, and exterior insulation, and flashings have been completed.
 - .2 Pre-substantial Phase: Installation of boarding and taping, exterior cladding, HVAC systems installed and operational.

3.11 ANALYSIS AND CORRECTIVE PROCEDURES

- .1 Repair all damages from testing.

- .2 Remediate non-conforming work identified during visual reviews and testing.
- .3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority or Third-Party Testing Agency, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.
- .4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.
- .5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to the DCC Representative for repairs or testing.

3.12 REPORTING

- .1 Prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.
- .3 Submit reports within five (5) working days following field observations and testing.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM D1970/D1970M-21, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - .2 ASTM D5385/D5385M-20, Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
 - .3 ASTM E96/E96M-16, Standard Test Method for Water Vapor Transmission of Materials
 - .4 ASTM E154/E154M-08a (2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .3 Submit two copies of WHMIS Safety Data Sheets (SDS).
- .3 Samples: Submit duplicate manufacturer's samples of sheet membrane waterproofing, minimum 100 x 100 mm, showing construction and materials.
- .4 Mock-up: Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .5 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Handle waterproofing materials in accordance with manufacturer's written directives, to prevent damage or loss of performance.

1.5 SITE CONDITIONS

- .1 Ambient Conditions: Do not install waterproofing when temperature is outside of range of manufacturer's recommendations.

Part 2 Products

2.1 SHEET WATERPROOFING MEMBRANE

- .1 Membrane: Styrene-butadiene-styrene (SBS) modified bitumen type, laminated to polyethylene film; smooth surfaced; 1.5 mm (60 mil) thick; release film; complete with compatible seam tape and termination bar; application temperature to -10°C.
 - .1 Water vapour permeability (ASTM E96, B): 2.5 ng/Pa·s·m² (0.04 perms).
 - .2 Hydrostatic resistance (ASTM D5385): 70 metres H₂O.
 - .3 Puncture resistance (ASTM E154): 222 N.
 - .4 Flexibility at -30°C (ASTM D1970): Pass.

2.2 ACCESSORIES

- .1 Primers and adhesives:
 - .1 Rubber-based construction adhesive or polymer emulsion-based primer for self-adhered membranes.
- .2 Thinner and cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane waterproofing.
- .3 Termination bars: Continuous aluminum, stainless steel, or galvanized steel, 3 x 25 x 25 mm, predrilled at 200 mm centers for mechanical attachment.
- .4 Seaming materials and sealants: As recommended by membrane manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Ensure surfaces are clean, dry, sound, smooth, continuous, and in compliance with waterproofing manufacturer's requirements.

3.2 PREPARATION

- .1 Protect adjacent surfaces not designated to receive waterproofing.
- .2 Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's written instructions.
- .3 Seal cracks and joints with sealant materials as recommended by sealant manufacturer.

3.3 INSTALLATION – SELF-ADHERED WATERPROOFING MEMBRANE

- .1 Install membrane waterproofing to manufacturer's instructions.
- .2 Roll out membrane. Minimize wrinkles and bubbles.
- .3 Remove release paper layer. Roll out on substrate with mechanical roller to ensure full contact bond.
- .4 Lap sides and ends in accordance with membrane manufacturer's written instructions.
- .5 Overlap edges and ends and seal permanently waterproof.
- .6 Seal membrane and flashings to adjoining surfaces.
- .7 Cover tears and inadequate laps. Seal edges of patches with mastic.

3.4 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.

- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Repair or replace defaced or disfigured finishes caused by work of this section.
- .5 Remove bituminous markings from finished surfaces in accordance with recommendations of manufacturer of surfaces.
- .6 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM D95-23, Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation
 - .2 ASTM D412-16 (2021), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
 - .3 ASTM D1227/D1227M-13(2024), Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
 - .4 ASTM D2240-15(2021), Standard Test Method for Rubber Property - Durometer Hardness
 - .5 ASTM E96/E96M-16, Standard Test Method for Water Vapor Transmission of Materials
- .2 Canadian General Standards Boards (CGSB):
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings
 - .2 CAN/CGSB-37.58-M86, Membrane, Elastomeric, Col-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing

1.2 SUBMITTALS

- .1 Perform in accordance with Section 01 33 00: Submittal Procedures.
- .2 Product Data: Provide data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.
- .3 Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- .4 Certificate: Certify that Products meet or exceed specified requirements.
- .5 Installation Data: Manufacturer's special installation requirements indicating special procedures and perimeter conditions requiring special attention.

1.3 PROJECT CONDITIONS

- .1 Ensure ambient air temperature is 5°C to 32°C at application time and temperature will remain above 5°C for at least 24 hours after application.

1.4 DELIVERY, STORAGE, AND PROTECTION

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MEMBRANE COMPOUND MATERIALS

- .1 Select appropriate material according to temperature at time of installation and according to manufacturer's recommendations.
- .2 Warm Weather Application:
 - .1 Elastomeric, liquid applied, emulsified asphalt membrane: one step liquid-applied. CAN/CGSB 37.2, ASTM D1227.
 - .1 Water Vapour Permeance (ASTM E96): 10 ng/Pa.m².s (0.2 perms).
 - .2 Chemical Resistance: Resistant to mild acids, alkalis, salt and calcium chloride solutions.
 - .3 Low Temperature Flexibility (CAN/CGSB 37.2M): No cracking, flaking or loss of adhesion.
 - .4 Elongation (ASTM D412): 2000%.
 - .5 Tensile Strength (ASTM D412): 320 kPa (typical) (50 psi).
- .3 Cold Weather Application:
 - .1 Cold-applied one component elastomeric waterproofing compound: CAN/CGSB-37.58; one step liquid-applied.
 - .1 Water Vapour Permeance (ASTM E96): 2.9 ng/Pa.m² .s (0.05 perms).
 - .2 Chemical Resistance: Non-resistant to oils or solvents. Resists mild acids, alkalis, salt and calcium chloride solutions.
 - .3 Application Temperature: -12 deg C (10.4 deg F) minimum.
 - .4 Elongation (ASTM D412): 1500%.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.

- .2 Verify substrate surfaces are thawed and dry, free of loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- .3 Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
 - .1 Concrete surfaces should have a wood float finish or smoother.
- .4 Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

- .1 Protect adjacent surfaces not designated to receive waterproofing.
- .2 Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's written instructions. Remove all loose or foreign material from the surface to be waterproofed.
- .3 Do not apply waterproofing to surfaces unacceptable to manufacturer.
- .4 Fill imperfections in the substrate with manufacturer's recommended product.

3.3 APPLICATION

- .1 Install fluid-applied waterproofing to manufacturer's written instructions.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 53 - Rough Carpentry
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.2 REFERENCE STANDARDS

- .1 ASTM International:
 - .1 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - .2 ASTM D1621-16(2023), Standard Test Method for Compressive Properties of Rigid Cellular Plastics
 - .3 ASTM D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics
 - .4 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .3 ULC Standards:
 - .1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 ULC S114:2018, Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - .3 CAN/ULC-S701.1:2017, Standard for Thermal Insulation, Polystyrene Boards
 - .4 CAN/ULC S702.1-2021, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for board insulation; include product characteristics, performance criteria, physical size, finish, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).

- .3 Shop Drawings:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.
 - .3 Indicate dimensions, loads, attachment methods, and related work.
 - .4 Provide fastening and strapping design based on manufacturer's recommendations for quantities and positioning of strapping for adequate support of rigid mineral-wool insulation boards. Insulation boards, strapping, cladding, and defined loads to be supported by the integrated insulation / strapping system.
- .4 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 INSULATION

- .1 Extruded polystyrene (XPS) for under slab and frost shield: To CAN/ULC S701.1.
 - .1 Type 4.
 - .2 RSI: Minimum 0.88 per 25 mm.
 - .3 Compressive strength: 275 kPa (40 psi).
 - .4 Thickness: As indicated.
 - .5 Size: 1220 x 2440 mm.

- .6 Edges:
 - .1 Frost shield: square.
 - .2 Under slab: shiplap.
- .2 Extruded polystyrene (XPS) for foundation wall: To CAN/ULC S701.1.
 - .1 Type 4.
 - .2 Compressive strength: 210 kPa (30 psi).
 - .3 Thickness: As indicated.
 - .4 Size: 1220 x 2440 mm.
 - .5 Edges:
 - .1 Foundation: shiplap.
- .3 Semi-rigid board for exterior walls: To ULC S702, Type 1; semi-rigid mineral wool board insulation for cavity wall assemblies.
 - .1 Non-combustibility (ULC S114): Pass.
 - .2 Surface burning characteristics (CAN/ULC S102):
 - .1 Flame spread: 0.
 - .2 Smoke developed: 0.
 - .3 Thermal resistance (ASTM C518): 0.76 m²·K/W at 25 mm thickness.
 - .4 Density (ASTM C303):
 - .1 Thicknesses up to 50 mm: 70 kg/m³.
 - .2 Thicknesses greater than 63 mm: 100 kg/m³ outer layer, 61 kg/m³ inner layer.
 - .5 Corrosive resistance (ASTM C665): Pass.
 - .6 Fungi resistance (ASTM C1338): zero mould growth.
 - .7 Attachments: Self adhered impaling pins and thermal ties for masonry finish. Refer to Section 04 43 23 - Quarried Stone Veneer Cladding.
- .4 Rigid board for exterior walls: To CAN/ULC S702.1, Type 1; rigid mineral wool board insulation for cavity wall assemblies.
 - .1 Compressive strength: 80, to ASTM C165, 21 kPa at 10% compression, 50 kPa at 25% compression.
 - .2 Non-combustibility (ULC S114): Pass.
 - .3 Surface burning characteristics (CAN/ULC S102):
 - .1 Flame spread: 0.
 - .2 Smoke developed: 0.
 - .4 Thermal resistance (ASTM C518): 0.72 m²·K/W at 25.4 mm thickness.
 - .5 Density (ASTM C303): 128 kg/m³.
 - .6 Corrosive resistance (ASTM C665): Pass.
 - .7 Fungi resistance (ASTM C1338): passed.
 - .8 Attachment: temporarily fastened with SA impaling pins, fastened via through insulation fasteners and strapping.

- .5 Concrete-faced insulation panels:
 - .1 Board insulation: CAN/ULC S701.1, Type 4, closed cell rigid board.
 - .1 Compressive strength (ASTM D1621): Minimum 240 kPa (35 psi).
 - .2 Thermal resistance (ASTM C518): RSI 0.88/25 mm (R 5.0/inch).
 - .3 Water absorption (ASTM D2842): Maximum 0.7% by volume.
 - .4 Water vapour permeance (ASTM E96): Maximum 45 ng/Pa•s•m² (0.8 perms).
 - .2 Concrete: Latex modified concrete, 8 mm (5/16 inch) thick.
 - .3 Thickness: As indicated on Drawings.
 - .4 Edges: Tongue and groove along longitudinal foam edges, but joints on lateral edges.
 - .5 Surface finish: Textured broom finish, grey.
 - .6 Fasteners: as recommended by manufacturer.
 - .1 Stainless steel fasteners to be used at all locations where fasteners are penetrating through rigid board insulation. Fastener information including size, type to be provided for review at the submittal stage.
 - .2 Manufacturer-supplied clips, galvanized steel to ASTM A123/A123M, G90 coating designation, complete with corrosion proof masonry fasteners.

2.2 ACCESSORIES

- .1 Accessories as recommended by manufacturer.
 - .1 Extruded polystyrene: foam adhesive and seam flashing tape
 - .2 CFI panels: clips
 - .3 Sub slab XPS: double sided tape
- .2 Accessories for mineral-wool board insulation:
 - .1 Wood strapping: refer to 06 10 00 Rough Carpentry.
 - .2 Fasteners: corrosion-resistant screws as recommended by manufacturer.
 - .3 Impaling fasteners for temporary attachment during installation.
- .3 Compressible fill: Expanded polystyrene compressible fill material designed to temporarily deform to accommodate soil movement resulting from freeze/thaw cycles.
- .4 Pest intrusion guard and insect screen. Galvanized steel, 1.1 x 1.3 mm (0.045 x 0.052 inch) screen openings, approximately 66% open area.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable for board insulation application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Ensure waterproofing below grade is fully cured.
- .3 If the lowest substrate surface is not level to receive panels, level surface with galvanized steel ledger angle, and secure in place.

3.2 INSTALLATION

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Install insulation boards with washer-style fasteners.
- .4 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Prepare joints and seal with seam flashing tape as recommended by insulation manufacturer.
- .8 Do not enclose insulation until it has been inspected and accepted by DCC Representative.
- .9 Expansion and control joints installed according to manufacturer's guidelines.

3.3 FOUNDATION INSULATION

- .1 Exterior application: Extend boards as indicated. Install on exterior face of perimeter foundation wall with fasteners acceptable to manufacturer.
- .2 Concrete faced panels:

- .1 Ensure snug fit between panel tongue and grooves, and lateral butt joints.
 - .2 Fasten concrete faced insulated panels to structural supports; align level and plumb.
 - .3 Install panels with vertical joints and panel control joints in alignment.
 - .4 Use manufacturer's fasteners. Maintain neat appearance.
 - .5 Cover exposed insulation at corners and top of perimeter insulation with prefinished flashing as specified in Section 07 62 00 – Sheet Metal Flashing and Trim.
 - .6 Where concrete flatwork or asphalt is to be laid adjacent to concrete faced panels, provide isolation joint to protect concrete faced insulation mortar surface from differential movement.
- .3 Under slab application: extend boards as indicated. Lay boards on level compacted fill.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.2 REFERENCE STANDARDS

- .1 ASTM International:
 - .1 ASTM C167-22 Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations
 - .2 ASTM C423-23, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - .3 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - .4 ASTM C665-17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .3 ULC Standards:
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC-S114:2018, Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - .3 CAN/ULC-S129-15, Standard Method of Test for Smoulder Resistance of Insulation (Basket Method)
 - .4 CAN/ULC-S702.1-2021, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for blanket insulation; include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).

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

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BATT INSULATION

- .1 Batt insulation for interior partitions: To CAN/ULC-S702.1, Type 1; mineral wool batt insulation.
- .1 Non-combustibility (CAN/ULC-S114): Pass.
- .2 Surface burning characteristics (CAN/ULC-S102):
- .1 Flame spread: 0.
- .2 Smoke developed: 0.
- .3 Density (ASTM C167):
- .1 Thicknesses ≥ 76 mm: 40 kg/m³.
- .2 Thicknesses < 76 mm: 45 kg/m³.
- .4 Smoulder resistance (CAN/ULC-S129): 0.09%.
- .5 Corrosive resistance (ASTM C665): Pass.
- .6 Sound absorption coefficients (ASTM C423):

Thickness (mm)	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
25	0.14	0.25	0.65	0.90	1.01	1.01	0.70
38	0.18	0.44	0.94	1.04	1.02	1.03	0.85
50	0.28	0.60	1.09	1.09	1.05	1.07	0.95
76	0.52	0.96	1.18	1.07	1.05	1.05	1.05
102	0.86	1.11	1.20	1.07	1.08	1.07	1.10

- .2 Batt insulation for exterior walls: To CAN/ULC-S702.1, Type 1; mineral wool batt insulation.
 - .1 Non-combustibility (CAN/ULC-S114): Pass.
 - .2 Surface burning characteristics (CAN/ULC-S102):
 - .1 Flame spread: 0.
 - .2 Smoke developed: 0.
 - .3 Density (ASTM C167): 32 kg/m³.
 - .4 Thermal resistance (ASTM C518): RSI 3.875 (R22) at 140 mm (5 1/2 inch) thickness.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable for batt insulation application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Verify acoustic and firestop sealants required at stud framing junctions with adjacent building components or at mechanical and electrical conduit and duct penetrations are installed.
- .3 Confirm mechanical, electrical, and telecommunications service lines in walls, ceilings, and floors to be insulated have been inspected.

3.2 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Install acoustic insulation where indicated to maintain sound attenuation of separation in building elements and spaces.
- .3 Place acoustic batts between studs ensuring friction fit, free of sags, folds, voids, or open joints that may let sound pass through.
- .4 Fit insulation closely around electrical boxes, pipes, ducts, frames, and other objects in or passing through insulation.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

- .6 Do not excessively compress insulation to fit into spaces.
- .7 Offset both vertical and horizontal joints in multiple layer applications.
- .8 Do not enclose insulation until it has been inspected by DCC Representative.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 25 00 - Air and Vapour Barriers

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- .2 CSA Group:
 - .1 CSA B149.1-15, Natural Gas and Propane Installation Code
 - .2 CSA B149.2:20, Propane Storage and Handling Code
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .4 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC):
 - .1 CCMC Registry of Product Evaluations
- .5 ULC Standards:
 - .1 CAN/ULC-S102.2-10, Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC-S114:2018, Test for Determination of Non-Combustibility in Building Materials
 - .3 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys
 - .4 CAN/ULC-S702-2021, Standard for Thermal Insulation, Mineral Fibre, for Building
 - .5 CAN/ULC-S703-09, Standard for Thermal Insulation, Cellulose Fibre Insulation (CFI) for Buildings

1.3 SUBMITTALS

- .1 Submit proof of manufacturer's CCMC Listing and listing number to DCC Representative.
- .2 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .3 Product Data: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

- .2 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Submit WHMIS Safety Data Sheets (SDS).

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.5 SITE ENVIRONMENTAL REQUIREMENTS

- .1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
- .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of insulation materials.
- .3 Ventilation:
 - .1 Contractor to arrange for ventilation system to be operated during installation of insulation.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Provide continuous ventilation during and after insulation application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of insulation installation.
- .4 Protection:
 - .1 Provide temporary enclosures to prevent dust from contaminating air beyond application area.
 - .2 Protect adjacent surfaces and equipment from damage by fall-out, and dust.

Part 2 Products

2.1 MATERIALS

- .1 Cellulose fibre insulation: to CAN/ULC S703, pure cellulose fibres, chemically impregnated to resist mould, mildew, and fire.

- .1 RSI: 11.44 (R 65).
- .2 Thermal resistivity: min 18.5 m·K/W.
- .3 Open flammability: min 0.12 W/cm².
- .4 Smoulder resistance: max 15%.
- .5 Moisture vapour absorption: max 20%.
- .6 Fungi resistance: Fungal growth shall not exceed that of the comparative item.
- .7 Separation of chemicals: max 1.5 %.
- .2 Attic eaves venting baffles: Plywood ventilation baffles, purpose-made, as indicated on drawings.
- .3 Vapour barrier: in accordance with Section 07 25 00 – Air and Vapour Barriers.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate previously installed are acceptable for loose fill insulation application in accordance with manufacturer's instructions.
 - .1 Inspect substrates.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

- .1 Provide temporary enclosures to prevent loose fill insulation dust from contaminating air beyond application area.
- .2 Protect adjacent surfaces and equipment from damage by fall-out and dust.

3.3 LOOSE FIBRE INSTALLATION

- .1 Install baffles as indicated to prevent insulation from spilling over top of exterior wall and causing blockage of soffit vents, and to prevent displacement of insulation by wind entering vents.
- .2 Pneumatically place loose fibre insulation above ceiling between joists to provide minimum thermal resistance value RSI as indicated.
- .3 Ensure ceiling areas exposed to outside air are insulated.
- .4 Ensure unobstructed air circulation to eave vents.
- .5 Keep insulation minimum 75 mm from heat emitting devices and recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 chimneys and CSA-B149.1, CSA-B149.2 type B and L vents.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .3 Leave Work area clean at end of each day.
- .4 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .5 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 25 00 - Air and Vapour Barriers

1.2 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .2 ULC Standards:
 - .1 CAN/ULC-S705.1-18, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification
 - .2 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for polyurethane spray foam insulation; include product characteristics, performance criteria, physical size, finish, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Test Reports:
 - .1 Submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Mock-up:
 - .1 Construct mock-up in accordance with Section 01 43 00 - Quality Assurance.

- .2 Construct mock-up, 10 m² minimum, of sprayed insulation including one inside corner and one outside corner, and window openings.
- .3 Mock-up may be part of finished work.
- .4 Allow for review of mock-up by DCC Representative before proceeding with sprayed insulation work.
- .2 Health and Safety Requirements: worker protection:
 - .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
 - .2 Workers must not eat, drink or smoke while applying foam insulation.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

- .1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

Part 2 Products

2.1 MATERIALS

- .1 Closed Cell Spray Foam Insulation: Spray polyurethane to CAN/ULC-S705.1, two-part, closed cell, 32 kg/m² (2 lb/ft³).

- .1 Air permeance: $< 0.005 \text{ L/s}\cdot\text{m}^2$.
- .2 Vapour permeance: 0.7 perm at 50 mm thickness.
- .3 Thermal performance: minimum RSI 1.95 at 50 mm thickness.
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.
- .3 Vapour barriers: in accordance with Section 07 25 00 – Air and Vapour Barriers.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable for sprayed insulation application accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 APPLICATION

- .1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.
- .2 Ensure vapour barrier is lapped and tied in to substrate as indicated in drawings.
- .3 Use primer where recommended by manufacturer.
- .4 Apply sprayed foam insulation in thickness as indicated, in maximum 50 mm lifts.
- .5 Remove insulation material spilled during installation and leave work area ready for application of wall board.

3.3 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

- .1 American Association of Textile Chemists and Colorists (AATCC)
 - .1 AATCC TM127-2017(2018)e, Test Method for Water Resistance: Hydrostatic Pressure.
- .2 ASTM International
 - .1 ASTM D412-16(2021), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - .2 ASTM D570-22, Standard Test Method for Water Absorption of Plastics.
 - .3 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - .4 ASTM D903-98(2017), Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - .5 ASTM D1970/D1970M-21, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - .6 ASTM D1976-20, Standard Test Method for Elements in Water by Inductively-Coupled Plasma Atomic Emission Spectroscopy.
 - .7 ASTM E84-23b, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .8 ASTM E96/E96M-16, Standard Test Method for Water Vapor Transmission of Materials.
 - .9 ASTM E154/E154M-08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - .10 ASTM E283-04, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .11 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .12 ASTM E331-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

- .13 ASTM E1643-18a, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- .14 ASTM E1745-17(2023), Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- .15 ASTM E2178-21a, Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.
- .16 ASTM E2357-18, Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 37-GP-56M-1985, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
 - .2 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .5 ULC Standards (ULC)
 - .1 CAN/ULC S741-08, Standard for Air Barrier Materials - Specification.
 - .2 CAN/ULC-S742-11, Standard for Air Barrier Assemblies - Specification.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Submit manufacturer's printed product literature, specifications, and datasheet. Include product characteristics, performance criteria, physical size, finish, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
 - .2 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 MOCK-UPS

- .1 Provide mock-ups in accordance with Section 01 43 00 - Quality Assurance and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

- .2 Vapour Barrier Mock-ups: Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box.
- .3 Air Barrier Mock-ups: Incorporate into construction of a typical exterior wall panel, full height by 3 m wide, incorporating door frame and sill, insulation, building corner condition, junction with roof system; illustrating materials interface and seals.
- .4 Locate where directed.
- .5 Mock-up will be used to judge quality of work, substrate preparation, and material application.
- .6 Allow for inspection of mock-up by DCC Representative before proceeding with air and vapour barrier work.
- .7 When accepted, mock-up will demonstrate minimum standard of quality required for this work.
- .8 Accepted mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.6 AMBIENT CONDITIONS

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .3 Maintain temperature and humidity recommended by material manufacturers before, during, and after installation.

1.7 SEQUENCING

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

Part 2 Products

2.1 GENERAL

- .1 Provide air barrier system components from one manufacturer.
- .2 Provide vapour barrier system components from one manufacturer.

2.2 SHEET MATERIALS

- .1 Smart Vapour Barrier: Vapour retarder (exterior and interior) moisture variable vapour control layer for permanently airtight building envelopes for wall and ceiling structures. Made from modified PE/PA polyethylene copolymer, reinforced with polypropylene or PET fibres, meeting or exceeding the following minimum requirements:
 - .1 Effective thickness: Min 0.25 mm (10 mil).
 - .2 Weight: Min 110 g/m² (0.36 oz/sf).
 - .3 Air Tightness : to ASTM E2178.
 - .4 Surface burning characteristics: ASTM E84
 - .1 Flame Spread: 0.
 - .2 Smoke Developed: max 75.
 - .5 Tensile properties:
 - .1 Min 270N/50mm (310N/50mm) Lengthwise
 - .2 Min 210N/50mm (260N/50mm) Crosswise
 - .6 Elongation:
 - .1 Min 15% Lengthwise
 - .2 Min 15% Crosswise
 - .7 Nail Tear Resistance:
 - .1 Min 110 N (140 N) Lengthwise
 - .2 Min 120 N (135 N) Crosswise
 - .8 Tapes: as recommended by manufacturer.
- .2 Vapour barrier for under concrete slabs: Polyolefin to ASTM E1745, Class A, 0.508 mm (20 mil) minimum thickness.
 - .1 Accessories: double sided tape as recommended by manufacturer.
- .3 Self Adhering Vapour Permeable Air Barrier: Self-adhered, vapour permeable, water resistive, air barrier, composed of one microporous functional layer laminated between two non-woven Polypropylene (PP) layers, with full-coverage pressure-sensitive glue layer applied to the reverse, to ASTM E2357.
 - .1 Thickness: 0.7 mm (28 mils).
 - .2 Water Vapor Permeance: 16 US perms per ASTM E96, Method A
 - .3 Air leakage:
 - .1 ASTM E2178 : Pass

- .2 ASTM E2357: Pass (including ASTM E283, ASTM E330, and ASTM E331)
- .3 CAN/ULC S741: Pass
- .4 CAN/ULC-S742: Classification A1
- .4 Water Penetration Resistance:
 - .1 AATCC TM127: Hydrostatic Pressure: ≥ 55 cm (22 inches)
 - .2 ASTM E331: Pass (No leaks @ 580 Pa (12.11 psf) on opaque and penetrated wall).
- .5 Lap Adhesion ASTM D1976: Pass
- .6 Nail Sealability ASTM D1970 Section 7.9: Pass
- .7 Tensile Strength ASTM D882: ≥ 20 lbf/in
- .8 Puncture resistance ASTM E154: 92 lbs
- .9 Surface Burning Characteristics ASTM E84:
 - .1 Flame Spread: 20 (Class A)
 - .2 Smoke Developed: 20 (Class A)
- .4 Mechanically attached Air Barrier: Spun-bonded polyolefin, non-woven, non-perforated.
 - .1 Air Penetration (ASTM E2178): Maximum 0.004 cfm/ft² at 1.57 psf.
 - .2 Water Vapour Transmission (ASTM E96 Method A): 50-60 perms.
 - .3 Water Penetration Resistance (AATCC 127): 250 cm.
 - .4 Tensile Strength (ASTM D882): min. 30 lbs/inch.
 - .5 Surface Burning Characteristics (ASTM E84): Class A.
 - .1 Flame Spread: ≤ 15 .
 - .2 Smoke Development: ≤ 15 .
- .5 Vapour barrier for wall and ceiling assemblies: Polyethylene film to CAN/CGSB-51.34, 0.15 mm (6 mil) minimum thickness.

2.3 THROUGH-WALL FLASHING MEMBRANE

- .1 Self-adhering air barrier membrane, SBS modified bitumen laminated to polyethylene film, vapour impermeable, cut to widths suitable for installation to window and door frames and other through-wall penetrations. Ensure compatibility with air barrier for remainder of system.
 - .1 Thickness: 1.0 mm (40 mil).
 - .2 Tensile strength (ASTM D412): Minimum 1.7 MPa.
 - .3 Water vapour permeance (ASTM E96): Maximum 2.8 ng/s•m²•Pa (0.05 perms).
 - .4 Water absorption (ASTM D570): Maximum 0.1%.
 - .5 Low temperature flexibility (CGSB 37-GP-56M): -30°C.
 - .6 Elongation (ASTM D412): Minimum 200%.

- .7 Puncture resistance (ASTM E154): Minimum 178 N (40 lb-f).

2.4 ACCESSORIES

.1 Tapes:

- .1 Single-sided, diffusible, and rainproof high-performance adhesive tape for permanent windtight bonding of component layers outdoors.
 - .1 Air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .2 Double-sided, blend of synthetic rubber and resins, for below-slab and crawl space water vapor barriers or retarders to concrete, masonry, wood, metal, and other surfaces.
 - .1 Total thickness: 0.76 mm (30 mil).
 - .2 Dimensions: 51 mm x 15.24 m (2" x 50').
- .3 Multi-layered, polyethylene film, aperture film, and acrylic pressure-sensitive adhesive. For underside of slab while concrete is placed. Allows wet concrete to cast into textured top surface to form mechanical bond/seal.
 - .1 Total thickness: 0.66 mm (26 mil).
 - .2 Dimensions: 152 mm x 55 m (6" x 180').
 - .3 180° Adhesion Peel Strength: ASTM D903 17.6 lbf/in.

- .2 Primer: As recommended by air barrier manufacturer and appropriate to application conditions.

.3 Grommets:

- .1 Sealing grommets for pipes, Ø 15 mm-30 mm (1/2"-1 3/16"), for interior and exterior use. Water-resistant solid adhesive, silicone-coated paper.
- .2 Sealing grommets for 1 cable, Ø 4.8-12 mm (3/16"-1/2"), for interior and exterior use. Water-resistant solid adhesive, silicone-coated paper.

.4 Sealant:

- .1 Vapour Barriers: Compatible with vapour barrier materials, recommended by vapour barrier manufacturer and to Section 07 92 00 - Joint Sealants.
- .2 Air Barriers: Mastic as recommended by air barrier manufacturer.

- .5 Staples: Minimum 6 mm leg.

- .6 Moulded box vapour barrier: Factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Verify surfaces and conditions are ready to accept work of this section.
- .2 Ensure surfaces are clean, dry, sound, smooth, continuous, and in compliance with air/vapour barrier manufacturer's requirements.
- .3 Report unsatisfactory conditions to DCC Representative.
- .4 Do not start work until deficiencies have been corrected.

3.3 PREPARATION

- .1 Remove loose or foreign matter that might impair adhesion of materials.
- .2 Ensure substrates are clean of oil or excess dust; open joints filled; and concrete surfaces free of large voids, spalled areas, or sharp protrusions.
- .3 Ensure substrates are free of surface moisture prior to application of self-adhesive membrane and primer.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces in accordance with manufacturer's instructions.

3.4 INSTALLATION - VAPOUR BARRIERS

- .1 Ensure services are installed and inspected prior to installation of vapour barrier.
- .2 Install vapour barrier on warm side of exterior wall assemblies to form continuous barrier.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.
- .5 Exterior Surface Openings:
 - .1 Cut vapour barrier to form openings and ensure material is lapped and sealed to frame with continuous bead of sealant and staples.
 - .2 Apply continuous bead of sealant to substrate at perimeter of sheets.
- .6 Perimeter Seals:
 - .1 Seal perimeter of vapour barrier as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.

- .3 Install staples through lapped sheets at sealant bead into wood substrate.
- .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .7 Lap Joint Seals:
 - .1 Seal lap joints of vapour barrier as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
 - .4 Install staples through lapped sheets at sealant bead into wood substrate.
 - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .8 Electrical Boxes:
 - .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
 - .1 Install moulded box vapour barrier on electrical boxes installed on exterior walls.
 - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.
- .9 Installation - Under Slab:
 - .1 Install under slab vapour barrier in accordance with ASTM E1643 and manufacturer's recommendations.
 - .2 Seal membrane to cast concrete slab with acrylic pressure sensitive adhesive tape.
 - .3 Lap seams minimum 150 mm (6 inches) and seal.
 - .4 Seal around permanent penetrations.
 - .5 Repair damaged areas of vapour barrier.
 - .6 Seal vapour barrier at terminating edges to foundation wall, slab, or grade beam.
 - .7 Vapour barrier is to be adhered to the sub slab XPS insulation via double sided tape along panel edges.

3.5 INSTALLATION - AIR BARRIERS

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Install air barrier in a continuous fashion with no gaps.
- .3 Lap and seal joints in accordance with manufacturer's recommendations.
- .4 Position lap seal over firm bearing.
- .5 Apply sealant within recommended application temperature range.

- .1 Consult manufacturer when sealant cannot be applied within recommended temperature range.
- .6 Where bridging of gaps (over 12 mm) occurs in the supporting substrate, provide minimum 0.76 mm (22 gauge) thick galvanized sheet metal or purpose-made reinforced backup sheet as recommended by membrane manufacturer.
- .7 At inside and outside corners, provide extra layer of membrane extending 200 mm each side of corner.
- .8 At wall-to-ceiling transitions, co-ordinate transition to maintain continuity of wall membrane with ceiling air barrier membrane.
- .9 At penetrations through air barrier membrane at structural members, ductwork, piping, conduits, and similar penetrations seal penetrations with grommet with elastomeric liquid air barrier coating compatible with self-adhesive membrane. Install flange as indicated.
- .10 Incorporate allowance for deflection of structure below roof beam locations, provide looped butyl membrane, mechanically fastened and sealed to air membrane and substrate.
- .11 Seal air barrier membrane to wind break window frames. Prior to installing window frame, wrap rough opening and extend air barrier membrane 200 mm beyond onto adjacent sheathing or wood buck of exterior wall. Fill void space between rough opening and window frame with low-expanding foam insulation and caulk to air barrier return.
- .12 Return air barrier membrane into pressed-steel door frame rough openings, fill void space between rough opening and frame with low-expanding foam insulation, and caulk to air barrier return.
- .13 Self-adhere air barrier membrane to aluminum storefront framing in accordance with storefront supplier recommendations.
 - .1 Storefront supplier is responsible for final fastening and sealing of air barrier to storefront.
- .14 Maintain air barrier membrane continuity at mechanical penetrations.
 - .1 Return air barrier membrane into rough openings.
 - .2 Install grommet according to manufacturer's recommendations.
 - .3 At galvanized ductwork and louvres, provide suitable galvanized metal or aluminum flange around perimeter of duct or louver for mechanical fastening and sealing of air barrier membrane.
- .15 Apply insulation as soon as possible after air barrier is installed. Do not leave applied air barrier exposed for longer than recommended by manufacturer.

3.6 INSTALLATION - THROUGH-WALL FLASHING MEMBRANES

- .1 Prime substrate in accordance with manufacturer's instructions.

- .2 Measure and cut through-wall flashing to required length, apply to rough openings, and integrate into wall air barrier system in accordance with manufacturer's instructions.
- .3 Hand roller or squeegee membrane into place per manufacturer's recommendations to smooth out wrinkles, air bubbles, and creases.
- .4 Form laps to shed water. Make laps in widths recommended by manufacturer.
- .5 Apply continuous bead of mastic sealant at laps, seams, penetrations, and along top edges of flashing membrane.
- .6 Keep edge of membrane flashing and mastic at least 13 mm (1/2 inch) away from exterior finish.

3.7 INSTALLATION - SELF-ADHERING SHEET AIR BARRIER

- .1 Install self-adhering sheet air barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
- .2 Remove release paper as membrane is applied.
- .3 Apply pressure with roller over surface of membrane while installing.
- .4 Ensure installed self-adhered membrane is free of wrinkles, fish mouths, and bubbles.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.9 PROTECTION OF WORK

- .1 Do not permit adjacent work to damage work of this section.
- .2 Ensure finished work is protected from climatic conditions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME):
 - .1 ASME B18.6.3-2024, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)
- .2 ASTM International (ASTM):
 - .1 ASTM E84-24, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .2 ASTM E2273-18, Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 93.4-92, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential
 - .2 CAN/CGSB 93.5-92, Installation of Metal Residential Siding, Soffits and Fascia
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .5 ULC Standards:
 - .1 CAN/ULC S135-04, Standard Method of Test for Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter)

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Submit manufacturer's instructions, printed product literature, and data sheets for metal siding; include product characteristics, performance criteria, physical size, finish, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:

- .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .2 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.
- .3 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, and related work.
- .4 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .5 Samples:
 - .1 Submit manufacturer's samples of siding material, of colour and profile specified.

1.4 QUALITY ASSURANCE

- .1 Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.6 WARRANTY

- .1 Provide CRCA two year fully comprehensive Labour and Materials Warranty on steep slope roofing works in this project, dated from time of Substantial Performance. Include associated inspections and reports during construction as outlined in CRCA Standard Form of Warranty.

Part 2 Products

2.1 PRODUCT REQUIREMENTS

- .1 Provide prefinished metal stock by same manufacturer as material in Section 07 61 00 - Sheet Metal Roofing, in same finish and colours. Gauge as noted.

2.2 MATERIALS

- .1 Exterior Sheet: Base metal with Z275 zinc coating, factory prefinished.
- .2 Insulation: Refer to 07 21 13 - Board Insulation.

2.3 STEEL CLADDING AND COMPONENTS

- .1 Type 1: Metal panel siding: to ASTM E84. Interlocking clip type with concealed fasteners.
 - .1 Metal thickness:
 - .1 Wall application: 0.68 mm (24 gauge).
 - .2 Width 500mm ($\pm$ 10mm), (20 Inches).
 - .3 Interlocking joints: 27 mm (1 1/16 inch) deep.
 - .4 Profile: Triangular Strip, 2 Flutes, with intermediate ribs.
 - .5 Pre-finished textural paint: PVDF.
 - .6 Colour: As selected by DCC Representative.
- .2 Type 2: Metal panel siding, CAN/ULC S135, ASTM E84, Class A. Galvanized steel, for horizontal or vertical installations.
 - .1 Pre-painted galvanized steel: 0.60 mm (24 gauge).
 - .2 Profile: Wood Texture. Width 155mm ($\pm$ 5mm), beveled face edges, preformed interlocking joints, slotted fastener holes pre-punched.
 - .3 Colour: As selected by DCC Representative.
- .3 Type 3: Metal panel siding, CAN/ULC S135, ASTM E84, Class A. Galvanized steel, for horizontal or vertical installations.
 - .1 Pre-painted galvanized steel: 0.60 mm (24 gauge).
 - .2 Profile: Width 155mm ($\pm$ 5mm), beveled face edges, preformed interlocking joints, slotted fastener holes pre-punched.
 - .3 Colour: As selected by DCC Representative.

2.4 SOFFITS

- .1 Soffits: to ASTM E84, pre-painted galvanized steel. Vented, 0.60 mm (24 gauge), flat, concealed screw fastening.
- .2 Dimensions:
 - .1 Width: 155 mm ($\pm$ 5mm), (6inches).
 - .2 Length: 3660 mm (12 ft).
- .3 Anti-siphoning space.
- .4 Fasteners: as recommended by manufacturer.

- .5 Colour: as selected by DCC Representative.

2.5 FASCIA AND EXPOSED TRIM

- .1 Fascia facings and exposed trim: to CAN/CGSB 93.4.
- .2 Profile: flat, manufacturer's standard, to match siding.
- .3 Pattern: Plain surface.
- .4 Base Metal Thickness: 0.559 mm (24 gauge).
- .5 Colour: as selected by DCC Representative.

2.6 FASTENERS

- .1 Furring and strapping: Refer to 06 10 00 - Rough Carpentry.
- .2 Screws: to ASTM B18.6.3, corrosion resistant, flanged hex heads with EPDM or silicone gaskets, self-drilling.

2.7 CAULKING

- .1 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

2.8 ACCESSORIES

- .1 Exposed trim: Inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim to match cladding, with slotted holes pre-punched.
 - .1 Finish: To match adjacent metal panel siding.
- .2 Siding vent strips: Extruded polypropylene, with drainage, air flow, and insect screen capabilities.
 - .1 Drainage efficiency (ASTM E2273): minimum 90%.
- .3 Vented Foam Closures: adhesive backing, as recommended by manufacturer. Approved as moisture and pest barrier, cut to paneling profile.
- .4 Tape: double-sided acrylic foam. Acrylic foam core, modified acrylic adhesive, total thickness of 1.1 mm (45 mil). Pressure sensitive, black.
 - .1 Tensile strength: minimum 620 Kpa (90 psi).

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 APPLICATION

- .1 Perform roof installation work in accordance with CRCA Roofing Application Standards Manual.
- .2 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install cladding horizontally and vertically as indicated, in accordance with CGSB 93.5, and manufacturer's written instructions.
- .2 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.
- .3 Install outside corners, fillers, and closure strips with carefully formed and profiled work.
- .4 Install vented foam closures per manufacturer's instructions.
- .5 Install soffit and fascia cladding as indicated.
- .6 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .7 Attach components in manner not restricting thermal movement.
- .8 Caulk junctions with adjoining work with sealant. Perform work in accordance with Section 07 92 00 - Joint Sealants.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM C627-18(2024) - Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
 - .2 ASTM E108-20a - Standard Test Method for Fire Tests of Roof Coverings
- .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 37.54-95 - Polyvinyl Chloride Roofing and Waterproofing Membrane
 - .2 CGSB 37-GP-55M-1979 - Application of Sheet Applied Flexible Polyvinyl Chloride Roofing Membrane
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .4 ULC Standards (ULC):
 - .1 CAN/ULC S107:2019, Standard Methods of Fire Tests of Roof Coverings

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Provide manufacturer's printed product literature, specifications and datasheets for membranes and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Provide shop drawings:
 - .1 Indicate tie-in, flashing, control joints, penetrations, and field fabricated seams details.

1.4 QUALITY ASSURANCE

- .1 Mock-ups:

- .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .2 Construct mock-up 10 m² minimum size showing typical installation and corners.
- .3 Construct mock-up where directed by DCC Representative.
- .4 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .5 Accepted mock-up will demonstrate minimum standard of quality required for this work.
- .6 Approved mock-up may remain as part of finished Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 roofing materials in accordance with manufacturer's written instructions, to prevent damage or loss of performance.
 - .3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

- .1 Provide manufacturer's 10-year warranty for membrane leaks due to a manufacturing defect, covering materials and/or repair and replacement labor.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Acceptable Substrate:
 - .1 Minimum 16 mm (5/8") exterior grade Fir plywood.
 - .2 Minimum 16 mm (5/8") T & G plywood subfloor.
- .2 Chemical Compatibility:

- .1 Membranes must not come in contact with bitumen or tar based products, pressure treated wood, polystyrene insulations, or copper based metals.
- .2 Membranes can be affected by chemicals found in commercial / residential environments. Many chemicals left to absorb into the membrane and / or then exposed to extreme heat or ultra violet light can cause permanent discoloration or damage to membranes.

2.2 MEMBRANES

- .1 Calendered polyvinyl chloride (PVC) film laminated to a woven, heat-set polyester fabric on back surface. A non-woven geo-textile polyester fabric laminated to top surface to accept overlay. To CAN/CGSB-37.54, ASTM C627.
 - .1 Sheet Width: 1830mm (72 inches).
 - .2 Sheet Thickness: 1.5 mm (0.060 inch / 60 mil).
 - .3 PVC Film Thickness: 1.3 mm (0.050 inch).
 - .4 Weight: 1864 g/m² (55 ounces per square yard) nominal.
 - .5 Fire Classification: ASTM E108, CAN/ULC S107, Class A and Class C.

2.3 ADHESIVES

- .1 Water-based Liquid Adhesive - trowel grade.
- .2 Water-based Liquid Adhesive - roller grade.
- .3 Liquid Contact Adhesive.

Part 3 Execution

3.1 SUBSTRATE EXAMINATION

- .1 Verify conditions of substrates are acceptable for 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 Fully adhere membrane to substrate in accordance with manufacturer's instructions, applicable codes, and CGSB-37-GP-55M.
- .2 Do not install when temperature is below 7 °C (45 °F) or above 37 °C (98 °F). Do not install when winds are gusting over 48 km/h (30 mph).
- .3 Do not dilute primers, adhesives, coatings, or sealants.
- .4 Install membrane with seams placed in direction of slope. Overlap field seams 38 mm (1.5 inch), heat-weld all seams in accordance with manufacturer's instructions.

- .5 Mechanically fasten all perimeter edges and penetrations.
- .6 Install flashings and accessories. Seal around all penetrations, drains, and edges.

3.3 FIELD QUALITY CONTROL

- .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 62 00 - Sheet Metal Flashing and Trim

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM D1970/D1970M-21, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - .2 ASTM D5206-24, Standard Test Method for Windload Resistance of Rigid Plastic Siding
 - .3 ASTM D5602/D5602M-18(2022), Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens
 - .4 ASTM E84-24, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials
 - .6 ASTM E1646-95(2024), Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
 - .7 ASTM E1680-16(2022), Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement
- .3 CSA Group (CSA):
 - .1 CSA A123.22-08, Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

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 sheet metal roofing and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Proof of manufacturer's CCMC listing and listing number.

- .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.
 - .3 Show arrangements of sheets and joints, types and locations of fasteners, and relationship of panels to structural frame.
 - .4 Provide wind uplift calculations.
 - .5 Indicate fastening requirements of metal panels to supporting substrate.
 - .6 Include snow guards sized for expected snow loads.
- .4 Samples:
 - .1 Submit manufacturer samples of each specified sheet metal material.

1.4 QUALITY ASSURANCE

- .1 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Fabricate mock-up, two panels wide by full height, using identical project materials and methods, including typical seam.
 - .3 Mock-up will be used to judge quality of work, substrate preparation, operation of equipment and material application.
 - .4 Locate where directed.
 - .5 Allow 24 hours for inspection of mock-up by DCC Representative before proceeding with sheet metal flashing work.
 - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.
 - .7 Approved mock-up may remain as part of finished Work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 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 sheet metal roofing from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.

1.6 WARRANTY

- .1 Provide CRCA two year fully comprehensive Labour and Materials Warranty on steep slope roofing works in this project, dated from time of Substantial Performance. Include associated inspections and reports during construction as outlined in CRCA Standard Form of Warranty.

Part 2 Products

2.1 PRODUCT REQUIREMENTS

- .1 Provide prefinished metal stock by same manufacturer as material in Section 07 46 13 - Preformed Metal Siding, in same finish and colours. Gauge as noted.

2.2 DESIGN/PERFORMANCE REQUIREMENTS

- .1 Design roof in accordance with ASTM E84 Class A, non-combustibility.
- .2 Design for wind loads, structural loads, and seismic performance.
- .3 Design to resist maximum sustained pressure to ASTM D5206.
- .4 Deflection of components not to exceed L/180.
- .5 Air tightness (ASTM E1680): maximum 0.36 L/s·m² at 300 Pa differential air pressure.
- .6 Water penetration (ASTM E1646): no uncontrolled water penetration at pressure 575 Pa.
- .7 Accommodate for movement in system due to thermal variation.

2.3 MATERIALS

- .1 Metal Roofing:
 - .1 Sheet steel 0.76 mm (22 gauge): prefinished.
 - .1 Pre-finishing: textural paint finish, PVDF.
 - .1 Colour: As selected by DCC Representative from manufacturer's standard range.
 - .2 Width 500mm (± 10mm), (20 inches).
 - .3 Interlocking joints: 27 mm (1 1/16 inch) deep.
 - .2 No perforations, length-wise joints, visible screws.
 - .3 Profile: Triangular Strip, 2 Flutes, with intermediate ribs.
 - .4 Fastening: concealed screws, as recommend by manufacturer, to resist wind uplift and sliding snow forces.

2.4 ACCESSORIES

- .1 Provide accessories by system manufacturer or as recommended by system manufacturer where possible.
- .2 Vented Foam Closures: adhesive backing, as recommended by manufacturer. Approved as moisture and pest barrier, cut to paneling profile.
- .3 Snow retention devices: As approved by sheet metal roofing manufacturer, bar style snow fence, with attachment clamps installed to vertical seams.
 - .1 Bars: aluminum extrusions, mill finish, with retainer for colour strip accessories.
 - .1 Provide 0.559 mm (24 gauge) colour strip inserts for faces of bars, colour matched to sheet metal roofing.
 - .2 Provide manufacturer's splicing devices for bars.
 - .2 Clamps: cast or machined billet aluminum, with round pointed set screws and integral mechanical attachment for bars; offset T profile, 38 mm deep, with 55 mm high face.
 - .1 Clamps that penetrate vertical seams are not permitted.
 - .3 Clips: purpose-made for attachment of bars to clamps
- .4 Vented ridge cap: Manufacturer's standard purpose made, same material and finish as roofing panels. For high snow load. Including support screen.
- .5 Seam sealant: As recommended by roof panel manufacturer.
- .6 Underlayment to CSA A123.22, self-adhering membrane composed of SBS modified bitumen laminated to woven polyethylene, non-slip surface, with release film. For high-temperature applications.
 - .1 Thickness: 1 mm.
 - .2 Tear resistance (ASTM D1970): 375/400 N.
 - .3 Static puncture resistance (ASTM D5602): 400 N.
 - .4 Low temperature flexibility (ASTM D1970): pass at -30°C.
 - .5 Service temperature: up to 115°C.
 - .6 Water vapour permeance (ASTM E96): < 2.1 ng/Pa·s·m².
 - .7 Nail sealability (ASTM D1970): Pass.
- .7 Plastic cement: To CAN/CGSB-37.5.
- .8 Touch-up paint: As recommended by sheet metal roofing manufacturer.
- .9 Eavestroughs and downspouts: Refer to Section 07 62 00 - Sheet Metal Flashing and Trim.
- .10 Pipe Boot: vent stack flashing, as recommended by manufacturer.
- .11 Isolation coating: Alkali resistant bituminous paint.

2.5 FABRICATION

- .1 General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements and structural requirements.
- .2 Form panels in continuous lengths for full length of detailed runs without joints.
- .3 Flashing: Section 07 62 00 – Sheet Metal Flashing and Trim.
 - .1 Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrate are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 APPLICATION

- .1 Perform roof installation work in accordance with CRCA Roofing Application Standards Manual.

3.3 INSTALLATION

- .1 Standing seam metal roof panels: Install weathertight metal panel system including roof panels, thermally broken structural support system, insulation, and air barrier membrane in accordance with manufacturers' written instructions, accepted shop drawings, and project drawings.
- .2 Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- .3 Include alignment bars, brackets, clips, inserts, shims as required to securely and permanently fasten roof system to building structure.
- .4 Attach panels to supports using clips, screws, fasteners, and sealants recommended by manufacturer and indicated on accepted shop drawings.
 - .1 Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
 - .2 Seams: Form standing seams with mechanical tool acceptable to roofing system manufacturer.

- .3 Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
- .4 Dissimilar Materials: Where elements of metal panel system contact dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- .5 Install vented foam closures per manufacturer's instructions.
- .6 Install trim, flashing, and accessories using recommended fasteners and joint sealants, with positive anchorage to building, and with weather tight mounting. Provide for thermal expansion. Coordinate installation with flashings and other components.
 - .1 Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 - .2 Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 - .3 Provide concealed fasteners except where noted on approved shop drawings.
 - .4 Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.
- .7 Snow retention devices: Install in accordance with manufacturer's instructions.
- .8 Joint Sealants: Install joint sealants where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.2 REFERENCES

- .1 The Aluminum Association Inc. (AAI):
 - .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002
- .2 ASTM International:
 - .1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants
 - .3 ASTM C1311-14, Standard Specification for Solvent Release Sealants
 - .4 ASTM D523-14(2018), Standard Test Method for Specular Gloss
 - .5 ASTM D822-23, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
 - .6 ASTM F1667-18a, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .3 Canadian Roofing Contractors Association (CRCA):
 - .1 Roofing Specifications Manual, current edition
- .4 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement.
- .5 CSA Group
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .7 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 Architectural Sheet Metal Manual, 2012.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications, and datasheets; and include product

- characteristics, performance criteria, physical size, finishes, and limitations.
- .2 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:
 - .1 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
 - .2 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.
 - .3 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, and related work.
- .4 Samples:
 - .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes, and colours.
- .5 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: ASTM A653/A653M, 0.60 mm (24 gauge) base metal thickness, commercial quality, with G90/Z275 designation zinc coating.
- .2 Pre-finish sheet metal with factory applied silicone modified polyester.
 - .1 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.
 - .2 Coating thickness: Minimum 25 micrometres.

- .3 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.
- .4 Colour: As selected by DCC Representative from manufacturer's standard range.

2.2 METAL FLASHINGS

- .1 Form flashings, copings to profiles indicated of minimum 0.60 mm (24 gauge) thick prefinished steel.
- .2 Built up wood column cladding profile: as indicated, 0.60 mm (24 gauge) thick prefinished steel.

2.3 ACCESSORIES

- .1 Isolation coating: Alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
- .3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.
- .4 Sealants: Refer also to Section 07 92 00.
 - .1 Sealing Tape: Polyisobutylene compound sealing tape with 100% solids and pressure sensitive release-paper backing. Provide non-toxic, non-staining permanent elastic tape.
 - .2 Elastomeric Sealant: Elastomeric polyurethane polymer sealant to ASTM C920, as required for watertight installation.
 - .3 Butyl Sealant: Single-component, solvent-release butyl rubber sealant to ASTM C1311, for use in joints with limited movement.
 - .4 Epoxy Seam Sealer: Aluminum seam-cementing compound, 2-part, non-corrosive, as recommended by manufacturer for exterior non-moving joints.
 - .5 Bituminous Coating: Cold-applied asphalt mastic, compounded for 0.4 mm (15-mil) dry film thickness per coat.
- .5 Cleats: Same material and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .6 Eavestrough hangers: Purpose-made for attachment of K-style gutters, aluminum, 1.5 mm (0.060 inch) minimum thickness, screw attachment, channeled or ribbed body.
- .7 Fasteners: Same material as sheet metal, to ASTM F1667, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .8 Washers: Same material as sheet metal, 1 mm thick with rubber packings.
- .9 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details as indicated.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- .3 Form pieces in 3660 mm (912 feet) maximum lengths.
 - .1 Lap flashing / fascia joints min 50 mm.
 - .2 Lap bent seams from vertical to horizontal flashing transitions.
- .4 Hem exposed edges on underside 12 mm.
 - .1 Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- .7 Seam seal all sheet metal connections with colour matched sealant.

2.5 EAVESTROUGHS AND DOWNSPOUTS

- .1 Form eavestroughs and downspouts from prefinished aluminum sheet metal.
 - .1 Eavestroughs: prefinished, width as indicated.
 - .2 Downspouts: Pre-formed rectangular, 100 x 152 mm (4 x 6 inches), corrugated.
- .2 Provide goosenecks, outlets, strainer baskets, and necessary fastenings.
- .3 Splash pads: Refer to Section 03 48 00 - Precast Concrete Specialties.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- .3 Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- .1 Install starter and edge strips, and cleats before starting sheet metal installation.

3.3 INSTALLATION

- .1 Install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.

- .2 Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- .3 Fit flashings tightly in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- .4 Lock end joints and caulk with sealant.
- .5 Where flashing installed with mechanical fasteners, install fasteners in slots or oversize holes to allow expansion and contraction of flashings.
- .6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .7 Insert metal flashing into reglets to form weather tight junction.
- .8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .9 Caulk flashing at reglet with sealant.
- .10 Install pans, where shown around items projecting through roof membrane.

3.4 EAVESTROUGHS AND DOWNSPOUTS

- .1 Install eavestroughs and secure to building at 450 mm on centre, with purpose-made eavestrough hangers.
 - .1 Slope eavestroughs evenly to downspouts.
 - .2 Provide endcaps at gutter ends.
 - .3 Seal joints watertight.
- .2 Install downspouts and provide goosenecks back to wall.
 - .1 Install downspouts, provide elbows and offsets, and secure downspouts to wall construction using downspout supports spaced maximum 1800 mm (6 feet) on center.
 - .2 Maximum distance of downspout support from top or bottom of downspout: 600 mm (24 inches).
 - .3 Provide 30° elbows extending minimum 200 mm at bottom of downspouts to direct water away from wall surface or foundation.
 - .4 Seal joints watertight. Seam seal all sheet metal connections with colour matched sealant.
 - .5 Where downspout connects to building perimeter drainage system, lap downspout and perimeter drainage pipe a minimum of 3 inches and seal joint with plastic cement.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave work areas clean, free from grease, finger marks, and stains.
- .3 Leave Work area clean at end of each day.

- .4 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .5 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM C612-14 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation
 - .2 ASTM E1966-24 - Standard Test Method for Fire-Resistive Joint Systems
 - .3 ASTM E2174-20a - Standard Practice for On-Site Inspection of Installed Firestop Systems
 - .4 ASTM G21-15(2021)e1 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- .2 Firestop Contractors International Association (FCIA):
 - .1 FCIA Firestop Industry Manual of Practice, 8th Edition
- .3 FM Global (FM):
 - .1 FM Approvals 4991 – Approval Standard for Firestop Contractors
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .5 UL (formerly Underwriters Laboratories):
 - .1 UL 2079, 2015 – Tests for Fire Resistance of Building Joint Systems
- .6 ULC Standards:
 - .1 CAN/ULC S101-14 –Fire Endurance Tests of Building Construction and Materials
 - .2 CAN/ULC S102-10 – Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .3 CAN/ULC S115-11 - Standard Method of Fire Tests of Firestop 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 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 datasheets. Include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings, and method of installation.
 - .2 Ensure construction details accurately reflect actual job conditions.
- .4 System Design Listings, including illustrations from a qualified testing and inspection agency as applicable for each firestop configuration.
- .5 Quality Assurance Submittals: Submit following in accordance with Section 01 43 00 - Quality Assurance:
 - .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: Signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: Including special handling criteria, installation sequence, and cleaning procedures.
- .6 Project Record Documentation: Supply documentation for each single application addressed. Identify each penetration and joint location on entire project. Provide at completion of project.
 - .1 Include the following for through-penetrations:
 - .1 Sequential location number.
 - .2 Project name.
 - .3 Installation date.
 - .4 Detailed description of penetration location.
 - .5 Tested System or Engineered Judgment Number.

- .6 Type of assembly penetrated.
- .7 Detailed description of size and type of penetrating item.
- .8 Size of opening.
- .9 Number of sides of assemblies addressed.
- .10 Hour rating achieved.
- .11 Installer's name.
- .2 Include the following for construction joints:
 - .1 Sequential location number.
 - .2 Project name.
 - .3 Installation date.
 - .4 Detailed description of construction joint location.
 - .5 Tested System or Engineered Judgment Number.
 - .6 Type of construction joint.
 - .7 Width of joint.
 - .8 Lineal footage of joint.
 - .9 Number of sides of assemblies addressed.
 - .10 Hour rating achieved.
 - .11 Installer's name.

1.4 QUALITY ASSURANCE

- .1 Manufacturer: Company specializing in manufacture of Products specified in this Section, with documented experience, and FCIA Manufacturer Membership in good standing.
- .2 Contractor: Company specializing in performing the work of this section, with documented experience, and with at least one of the following qualifications:
 - .1 Approved in accordance with FM Standard 4991.
 - .2 FCIA Member in good standing.
 - .3 UL Approved Contractor.
 - .4 Licensed by the local authority having jurisdiction.
- .3 Installer Qualifications:
 - .1 All firestopping installation work for entire project shall be by a single contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.
 - .2 Installer shall be a company specializing in fire stopping installations, approved by material manufacturer and be a member in good standing with the Firestop Contractor International Association (FCIA).
- .4 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.
- .5 Regulatory Requirements:

- .1 Conform to applicable code for fire resistance ratings and surface burning characteristics.
- .2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.
- .6 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and DCC Representative in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building sub-trades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .7 Site Meetings: As part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

- .1 Apply materials within temperature range recommended by manufacturer.
- .2 Maintain recommended temperature before, during, and for 72 hours after installation of materials.

1.7 SEQUENCING AND SCHEDULING

- .1 Schedule installation of cast-in-place firestop devices after completion of floor formwork, metal form deck, or composite deck, but before placement of concrete.
- .2 Schedule installation of drop-in firestop devices after placement of concrete but before installation of pipe penetration.

- .3 Schedule installation of other firestopping materials after completion of penetrating item installation, but prior to covering or concealing of openings.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Materials, accessories, and application procedures: Listed by ULC, cUL, or tested in accordance with CAN/ULC S115 to comply with applicable building code requirements.
- .2 Firestopping materials: To CAN/ULC S101, to achieve fire rating as noted on Drawings and ULC Design Number shown.

2.2 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.
 - .2 Ensure firestopping system components are fully compatible with each other, with substrates, and with items penetrating the firestopping.
 - .3 Mould and mildew resistance to ASTM G21: 0 (Zero).
- .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 Insulation: Mineral wool fibre semi-rigid insulation to ASTM C612 – Type IVA, UL 2079, and ASTM E1966; minimum density 64 kg/m³ (4 lbs/ft³).
- .10 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.
- .11 Sealants for vertical joints: Non-sagging.

- .12 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this Section.
- .3 Proceed with installation only when unsatisfactory conditions have been corrected.

3.3 PREPARATION

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

3.4 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.

3.5 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by DCC Representative.

3.6 LABELLING

- .1 Provide and install identification labels for each individual penetration with firestopping.
 - .1 Install labels in readily visible location, on both sides of penetrated assembly, with permanently bonding adhesive.
 - .2 Label to include:
 - .1 Warning indicating that system is firestopping installation to be left undisturbed.
 - .2 Installing Contractor name and contact information.
 - .3 System designation of testing organization.
 - .4 Installation date.
 - .5 Manufacturer.

3.7 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Quality Control.
- .2 Inspections: Notify DCC Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .3 Inspections to be in accordance with ASTM E2174 or other recognized standard.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove temporary dams after initial set of firestopping and smoke seal materials.
- .3 Leave Work area clean at end of each day.
- .4 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .5 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.2 REFERENCES

- .1 ASTM International (ASTM):
 - .1 ASTM C919-24, Standard Practice for Use of Sealants in Acoustical Applications
 - .2 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants
 - .3 ASTM C1193-16, Standard Guide for Use of Joint Sealants
 - .4 ASTM C1330-18, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
 - .5 ASTM D1056–20, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
 - .6 ASTM D2628-91(2016), Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound
- .3 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act, 1999 (CEPA)
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .5 Sealant, Waterproofing, and Restoration Institute (SWRI):
 - .1 Sealants: The Professionals' Guide 2013
- .6 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)

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 joint sealants. Include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Manufacturer's product to describe:
 - .1 Caulking compound.

- .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Samples:
 - .1 Submit 2 samples of each type of material and colour.
 - .2 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .4 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .5 Manufacturer's Instructions:
 - .1 Submit installation instructions for each product used.

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

- .1 Compatibility: Verify sealants used are compatible with their respective joint substrates.
- .2 Provide sealants with appropriate expansion and contraction properties for the joints being sealed.
- .3 Perform sealant application work to ASTM C1193.
- .4 Perform acoustic sealant application work to ASTM C919.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Perform accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in ventilated dry indoor location and in accordance with manufacturer's recommendations.
 - .2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

- .3 Do not dispose of unused sealant material into sewer system, streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .4 Divert unused joint sealing material from landfill to official hazardous material collections site approved by the DCC Representative.

1.7 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Proceed with installation of joint sealants only when:
 - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4°C.
 - .2 Joint substrates are dry.
 - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-Width Conditions:
 - .1 Proceed with installation of joint sealants only where joint widths are within range allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 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 Safety Data Sheets (SDS) acceptable to Health Canada.
- .2 Ventilate area of work as directed by DCC Representative by use of approved portable supply and exhaust fans.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Each sealant system shall meet the following requirements for warranty period:
 - .1 Waterproof, flexible, and compatible with substrate under applicable service conditions.
 - .2 Provide a weather-tight seal that does not allow moisture penetration.
 - .3 Shall not de-bond, crack, or craze.
 - .4 Shall not leak.

2.2 SEALANT MATERIALS

- .1 In air handling units and supply air system, use sealants without strong odours, without toxic chemicals, and are mould-resistant. When low toxicity sealants 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.
- .2 Provide primers in accordance with manufacturer recommendation.

2.3 SEALANT MATERIAL DESIGNATIONS

- .1 Type S-2: Silicone Sealant; mould and mildew resistant.
 - .1 To ASTM C920; type S; grade NS; class 50; use NT, G, and A.
 - .2 To ASTM C920; type S; grade NS; class 25; use NT, G, and A.
- .2 Type S-3: Silicone Sealant; general construction and air-seal sealant.
 - .1 To ASTM C920: type S; grade NS; class 25; use NT, M, G, A, O.
- .3 Type S-4: Silicone Sealant; structural glazing.
 - .1 To ASTM C920: type S; grade NS; class 25; use NT, A, G, O.
- .4 Type S-5: Acoustical Sealant; interior, non-skimming, non-hardening, simple component synthetic rubber sealant, to ASTM C919.
- .5 Type S-6: Multi-component polyurethane sealant; chemical curing, exterior wall sealant.
 - .1 To ASTM C920: type M; grade NS; class 50; use T, NT, M, A, O.
- .6 Type S-7: One-component polyurethane sealant; non-sag, for general construction.
 - .1 To ASTM C920: type S; grade NS; class 25; use NT, M, A, O.
- .7 Type S-8: Horizontal joint sealant; two component, self-levelling.
 - .1 To ASTM C920: type M; grade P; class 25; use T, M, O.
- .8 Type S-9: One part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to ASTM C920, type S, grade P, class 50, use T, M, A, O, MC-1-25-B-N.
- .9 Type S-10: Control joint sealant: two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.
- .10 Type S-11 Control Joint Sealant: Two component, polyurea based, load bearing, self levelling sealant.
- .11 Type S-12 Control Joint Sealant: Two component, semi-rigid epoxy, load bearing, self levelling sealant.
- .12 Type S-13: One-component polyurethane sealant; medium-modulus, non-sag, low-VOC, UV stable, to CAN/CGSB-19.24.

2.4 SEALANT SELECTION

- .1 Where no specific type of sealant is scheduled, provide one of the sealants indicated in this Section appropriate for its application and consistent with manufacturer's recommendations and recommendations of SWRI, Sealants: The Professionals' Guide.
- .2 Make sealant selections consistent with manufacturer's recommendations.
- .3 Use mould and mildew resistant silicone sealant Type S-2 for non-moving joints in washrooms and kitchens. Do not use on floors.
- .4 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type specified.
- .5 Use structural glazing silicone Type S-4 for sealing glass, interior and exterior.
- .6 Use acoustical sealant Type S-5 and air seal sealant Type S-3 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.
- .7 Use multi component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.

2.5 ACCESSORIES

- .1 Preformed compressible and non-compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing:
 - .1 Rod Type Sealant Backings:
 - .1 ASTM C1330, Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi cellular material with a surface skin).
 - .2 Provide any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.
 - .3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - .4 Non-adhering to sealant, to maintain two-sided adhesion across joint.
 - .2 High Density Foam:
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .3 Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, non absorbent to water and gas, capable of remaining resilient at temperatures down to 15°C. Provide products with low compression set and of size and shape to provide

secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

.4 Bond Breaker Tape:

- .1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.

.2 Preformed Sealants:

- .1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to substrates.
- .2 Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open cell compression type complying with ASTM D2628 and with requirements for size, profile and cross sectional design.

.3 Bond Breaker: Pressure-sensitive plastic tape that will not bond to sealants.

.4 Joint Cleaner: Provide a non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's recommendations

.5 Primer: Provide in accordance with sealant manufacturer's recommendations.

.6 Masking Tape: Non-absorbent type, non-staining, compatible with joint sealant and joint substrates.

2.6 COLOURS

- .1 Sealant Colours: Match colour of adjacent materials where visible, as selected by the DCC Representative, from manufacturer's complete colour range.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for joint sealants installation in accordance with manufacturer's instructions.
- .1 Visually inspect substrate.
- .2 Verify joint surfaces are dry and frost free.
- .3 Verify substrates are without contaminants capable of interfering with sealant adhesion. Remove contaminants where occurring.
- .4 Examine joint sizes and conditions to establish acceptable depth to width ratio for installation of backup materials and application of sealants.
- .5 Verify joint widths are within the limits recommended by joint sealant manufacturer for applications indicated.

- .6 Inform the DCC Representative of unacceptable conditions immediately upon discovery.
- .7 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SURFACE PREPARATION

- .1 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair Work.
- .2 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.
- .3 Prepare surfaces in accordance with manufacturer's directions.
- .4 Mask adjacent surfaces prior to priming and sealing where necessary to prevent staining.

3.3 PRIMING

- .1 Prime sides of joints in accordance with sealant manufacturer's instructions immediately applying sealant, except when manufacturer's instructions explicitly state priming is not required.
- .2 Prime all porous material (e.g. wood, masonry, concrete, ceramic or paver tile, etc.).

3.4 BACKUP MATERIAL

- .1 Provide backer rod as specified, to limit depth of sealant and to act as bond breaker at back of joint.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.
- .3 Apply paper masking tape to back of joint to act as bond break where depth of joint does not permit the use of backer rod.
- .4 Ensure that no joints are formed which are bonded on adjacent sides where there is any possibility of movement.

3.5 MIXING

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

3.6 APPLICATION

- .1 Sealant: Application: Apply sealants to recommendations of ASTM C1193, in accordance with manufacturer's instructions, and as follows:
 - .1 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.

- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 For joints where movement is possible, apply backer rod to achieve a joint depth of one half the joint width but not less than 9 mm; for joints larger than 25 mm use a depth of 13 mm.
- .4 Apply sealant in continuous beads.
- .5 Apply sealant using gun with proper size nozzle.
- .6 Fill voids and joints solid.
- .7 Form sealant surface with a smooth full bead, without from ridges, wrinkles, sags, air pockets, embedded impurities.
- .8 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .9 Ensure bead is solid, filling entire space between sides and bedding material, exerting sufficient pressure to obtain maximum bond, by allowing sealant to bulge out in advance of nozzle.
- .10 Seal at locations where dissimilar materials meet.
- .2 Sealant Curing:
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until after curing has completed.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials 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.
 - .2 Do not dispose of unused sealant materials into sewer system, streams, lakes, onto ground, or other location where it might pose a health or environmental hazard.
 - .3 Divert unused sealants from landfill to a hazardous material collection site.
 - .4 Place materials defined as hazardous or toxic in designated containers.
 - .5 Dispose of hazardous materials in accordance with the CEPA, TDGA, regional and municipal regulations.

3.8 PROTECTION

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

3.9 SCHEDULE

- .1 Use mould and mildew-resistant silicone sealant Type S-2 for non-moving joints in washrooms and kitchens. Do not use on floors.
- .2 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for joints, interior and exterior, where no other specific sealant type is specified.
- .3 Use structural glazing silicone Type S-4 for sealing structural glass and sealing butt-to glazing joints, interior and exterior.
- .4 Use acoustical sealant Type S-5 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across joint.
- .5 In addition, provide joint sealants at the following conditions:
 - .1 Seal perimeters of hollow metal door frames on both sides.
 - .2 Seal control joints in gypsum board, except where prefabricated control joints are specified.
 - .3 Seal junctures between interior partitions with exterior walls.
 - .4 Seal window and door frames around inside perimeters, so that airtight seal is obtained.
 - .5 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.
 - .6 Perimeter of bath fixtures (including sinks, urinals, water closets, basins, vanities).
 - .7 Expansion and control joints in exterior surfaces of poured-in-place concrete walls.
 - .8 Expansion and control joints in exterior surfaces of precast architectural wall panels.
 - .9 Movement, control and expansion joints in exterior surfaces of unit masonry walls.
 - .10 Coping joints and coping-to facade joints.
 - .11 Cornice and wash (or horizontal surface joints).
 - .12 Seal interior perimeters of exterior openings.
 - .13 Control and expansion joints on the interior of exterior cast-in place concrete walls.
 - .14 Expansion and control joints on the interior of exterior precast, architectural wall panels.
 - .15 Joints of underside of precast beams or planks.
 - .16 Movement, control and expansion joints on the interior of exterior surfaces of unit masonry walls.
 - .17 Interior control and expansion joints in floor surfaces.
 - .18 Perimeters of interior frames.
 - .19 Movement, control and expansion joints in exterior surfaces of unit masonry walls.

- .20 Joints at tops of non-load bearing masonry walls at the underside of poured concrete.
- .21 Exposed interior control joints in gypsum board.
- .6 Refer to Section 07 84 00 – Firestopping for additional requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section includes labour and materials required to complete conformance testing and reporting of openings.

1.2 RELATED SECTIONS

- .1 Section 08 11 00 - Metal Doors and Frames
- .2 Section 08 16 13 - Fiberglass Doors
- .3 Section 08 31 13 - Attic Hatches
- .4 Section 08 41 13 - Aluminum Framed Entrances and Storefronts
- .5 Section 08 53 13 - Vinyl Windows
- .6 Section 08 80 00 - Glazing

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Building Envelope Testing; by Third-Party Inspection and Testing Agency, hired by Contractor.
- .3 Co-ordinate visual review and testing frequency and locations with Third-Party Inspection and Testing Agency to facilitate review of multiple distinct building envelope elements and components during the same visit.
- .4 Costs incurred for additional testing for items not meeting the specifications including costs for transportation and for required modifications to be the responsibility of the Contractor.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
 - .2 ASTM E1105-15 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
 - .3 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

- .2 CSA Group:
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights
 - .2 CSA A440SI-09 - Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights
- .3 International Organization for Standardization (ISO):
 - .1 ISO 17025:2005, General requirements for the competence of testing and calibration laboratories

1.5 BUILDING ENVELOPE COMMISSIONING PRE-CONSTRUCTION CONFERENCE

- .1 Building Envelope Commissioning Pre-Construction Conference in accordance with General Requirements.
- .2 Convene Building Envelope Commissioning Pre-Construction conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Contractor, DCC Representative, Commissioning Authority, Building Envelope Commissioning Authority (hired by DCC Representative), Third-Party Inspection and Testing Agency and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review compatibility of materials.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test, maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all aluminum windows and associated adjacent wall assembly components, shall provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.

- .4 Product Data:
 - .1 Provide product data for:
 - .1 Section 08 11 00 - Metal Doors and Frames
 - .2 Section 08 16 13 - Fiberglass Doors
 - .3 Section 08 31 13 - Attic Hatches
 - .4 Section 08 41 13 - Aluminum Framed Entrances and Storefronts
 - .5 Section 08 53 13 - Vinyl Windows
 - .6 Section 08 80 00 - Glazing
- .5 Shop Drawings:
 - .1 Provide shop drawings for:
 - .1 Section 08 11 00 - Metal Doors and Frames
 - .2 Section 08 16 13 - Fiberglass Doors
 - .3 Section 08 31 13 - Attic Hatches
 - .4 Section 08 41 13 - Aluminum Framed Entrances and Storefronts
 - .5 Section 08 53 13 - Vinyl Windows
 - .6 Section 08 80 00 - Glazing
- .6 Qualification Statements:
 - .1 Submit proof of Third-Party Inspection and Testing Agency qualifications for review and acceptance:
 - .1 Proof of ISO 17025 accreditation.

1.7 THIRD-PARTY INSPECTION AND TESTING AGENCY

- .1 Third-Party Inspection and Testing Agency:
 - .1 Third-party accredited testing laboratory.
 - .2 Accredited to ISO 17025.

1.8 QUALITY ASSURANCE

- .1 Notify the DCC Representative, Commissioning Authority, Building Envelope Commissioning Authority, and the Third-Party Inspection and Testing Agency in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor's work shall be carried out by the Third-Party Inspection and Testing Agency.
- .2 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or testing of openings:
 - .1 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the openings including thermal and moisture protection components.

- .2 Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Third Party Inspection and Testing Agency.
- .2 On-Site Quality Assurance Review and/or Testing
 - .1 Visual review and testing of the installed openings including thermal and moisture protection components may be periodically completed at the discretion of the Third-Party Inspection and Testing Agency.
 - .2 Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Third-Party Inspection and Testing Agency.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 METAL DOORS AND FRAMES

- .1 Provide a mock-up of metal doors and frames at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.2 FIBERGLASS DOORS

- .1 Provide mock-up of fiberglass door at location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
 - .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, door hardware, and any other detailed assembly components.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.

- .1 Provide a mock-up of attic hatches at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:

- .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.4 ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

- .1 Provide a mock-up of aluminum framed entrances and storefronts at a location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.

3.5 VINYL WINDOWS

- .1 Provide mock-up of window frame at location identified by the Third-Party Inspection and Testing Agency prior to full system installation.
 - .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, and any other detailed assembly components.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Third-Party Inspection and Testing Agency to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Third-Party Inspection and Testing Agency.
- .3 Testing: Mock-Up and Functional Performance:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.

- .2 Water penetration testing under uniform or cyclic static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 ASTM E1105.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Cyclic method.
 - .3 Include the rough opening.
- .2 Quantitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E783.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization or depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
- .4 Test pressure in accordance with:
 - .1 Section 08 54 13.
- .5 Frequency of Testing:
 - .1 Once during Mock-up.
 - .2 Two (2) additional units randomly selected during remainder of installation.

3.6 ANALYSIS AND CORRECTIVE PROCEDURES

- .1 Repair all damages from testing.
- .2 Remediate non-conforming work identified during visual reviews and testing.
- .3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority or Third-Party Testing Agency, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.
- .4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.

- .5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to the DCC Representative for repairs or testing.

3.7 REPORTING

- .1 Prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.
- .3 Submit reports within five (5) working days following field observations and testing.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 08 00 - Commissioning of Openings
- .3 Section 08 71 00 - Door Hardware
- .4 Section 08 80 00 – Glazing
- .5 Section 09 91 00 - Painting

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM D4726-18, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .3 CSA Group:
 - .1 CSA A440.4:19, Window, Door, and Skylight Installation
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .5 National Fire Protection Association (NFPA):
 - .1 NFPA 80-2013, Standard for Fire Doors and Other Opening Protectives
 - .2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2022 Edition
- .6 Steel Door Institute (SDI):
 - .1 SDI-111-09, Recommended Details for Standard Steel Doors, Frames, Accessories and Related Components
 - .2 SDI-122-15, Installation and Troubleshooting Guide for Standard Steel Doors and Frames
- .7 ULC Standards:
 - .1 CAN/ULC S104-15, Standard Method for Fire Tests of Door Assemblies
 - .2 CAN/ULC S105:2016, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC S104

- .3 CAN/ULC-S106-15, Standard Method for Fire Tests of Window and Glass Block Assemblies
- .4 CAN/ULC-S701.1:2017, Standard for Thermal Insulation, Polystyrene Boards

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop drawings:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.
 - .3 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware, fire ratings, and finishes.
 - .4 Indicate each type of frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, fire ratings, and finishes.
 - .5 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .4 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 08 08 00 - Commissioning of Openings.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.

- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 or NFPA 252 for ratings specified or indicated.
- .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S106 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

2.2 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, minimum base steel thickness in accordance with SDI-111.
- .1 Galvanizing thickness: Z120 (G40).

2.3 DOOR CORE MATERIALS

- .1 Expanded polystyrene: CAN/ULC-S701.1, rigid extruded, fire retardant, closed cell board. Density 16 to 32 kg/m³, thermal values RSI 1.0 minimum.

2.4 ADHESIVES

- .1 Steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Lock-seam doors: Fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Section 09 91 00 - Painting. Protect weather strips from paint. Provide final finish free of scratches or other blemishes.
- .2 Touch-up zinc primer to CAN/CGSB 1.181.

2.6 ACCESSORIES

- .1 Door Hardware: Refer to Section 08 71 00 - Door Hardware.
- .2 Door silencers: Single stud rubber/neoprene type.
- .3 Exterior top caps: Rigid polyvinylchloride extrusion conforming to ASTM D4726.
- .4 Astragals: 14 gauge steel, 44 mm wide, full height.
- .5 Metallic paste filler: To manufacturer's standard.
- .6 Fire labels: Metal riveted.

- .7 Sealants: Refer to Section 07 92 00 - Joint Sealants.
 - .1 Rough opening fill: low pressure build spray applied polyurethane foam.
 - .2 Perimeter joint sealing:
 - .1 Interior doors: Polyurethane.
 - .2 Exterior doors: Elastomeric polyurethane.
- .8 Glazing Stops: Formed galvanized steel channel, minimum 16 mm high, accurately fitted, butted at corners and fastened to frame sections with counter-sunk, tamper proof sheet metal screws.
- .9 Glass: Refer to Section 08 80 00 - Glazing.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with SDI-111.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Frames: 1.6 mm thick steel, welded construction.
 - .1 Provide 16 mm minimum stop height for factory-sealed double-glazed units.
- .4 Blank, reinforce, drill and tap frames for mortised, and templated hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Protect mortised cut-outs with steel guard boxes.
- .6 Reinforce frames for surface mounted hardware.
- .7 Prepare door openings for single stud rubber door silencers.
- .8 Label fire-rated frames.
- .9 Conceal fastenings except where exposed fastenings are indicated.
- .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .11 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
 - .1 Thermal break: Rigid polyvinylchloride extrusion conforming to ASTM D4726.
- .12 Fill frame cavity with low pressure build spray applied polyurethane foam.

2.8 FRAME ANCHORAGE

- .1 Shim and anchor new doors in accordance with CAN/CSA A440.4.
- .2 Provide appropriate anchorage to floor and wall construction.
- .3 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

- .4 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.
- .5 Locate anchors for frames in existing openings maximum 150 mm from top and bottom of each jamb and intermediate at 660 mm on centre maximum.

2.9 FRAMES: KNOCKED-DOWN TYPE

- .1 Ship knocked-down type frames unassembled.
- .2 Provide frames with mechanical joints that inter-lock securely and provide functionally satisfactory performance when assembled and installed in accordance with SDI-122.
- .3 Securely attach floor anchors to inside of each jamb profile.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: Swing type, flush, with provision for glass openings as indicated.
- .2 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .3 Factory-prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .4 Reinforce doors where required, for surface mounted hardware.
- .5 Factory-weld full height astragals to active leaf of double doors as scheduled.
- .6 Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Label fire rated doors with riveted metal label.

2.11 DOORS: LAMINATED CORE CONSTRUCTION

- .1 Fabricate doors with longitudinal edges lock-seamed, adhesive assisted.
 - .1 Seams: Visible.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION GENERAL

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Install doors and frames to SDI-122 and CSA A440.4.
- .3 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level, and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position until built-in:
 - .1 Remove temporary steel shipping jamb spreaders.
 - .2 Supply and install wood spreaders at third points of frame rebate height to maintain frame width until building-in work completed.
 - .3 Supply vertical support at centre of head for openings exceeding 1200 mm in width.
 - .4 Remove wood spreaders after frames have been built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Fill gaps between rough openings and frames with low pressure build spray applied polyurethane foam.
- .6 Caulk perimeter of frames between frame and adjacent material.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor: 13 mm.
- .3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

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

3.6 GLAZING

- .1 Install glazing for doors and frames in accordance with Section 08 80 00 - Glazing.

3.7 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by steel doors and frames installation.
- .3 Protect thresholds, hardware, frames, doors, and glass from damage. Lock operative door bottoms in up position.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
 - .1 North American Architectural Woodwork Standards, v 4.0, 2021, including Errata
- .2 CSA Group:
 - .1 CAN/CSA O132.2 Series-90, Wood Flush Doors
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .4 National Fire Protection Association (NFPA):
 - .1 NFPA 80-2013, Standard for Fire Doors and Other Opening Protectives
 - .2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2022 Edition
- .5 ULC Standards:
 - .1 CAN/ULC S104-15, Standard Method for Fire Tests of Door Assemblies
- .6 Window and Door Manufacturers Association (WDMA):
 - .1 ANSI/WDMA I.S. 1A-21, Interior Architectural Wood Flush Doors

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, data sheets and installation instructions. Include door core materials, thickness, construction, and veneer species.
 - .2 Submit WHMIS Safety Data Sheets (SDS).
 - .1 Indicate VOC content for door materials and adhesives.
- .3 Shop Drawings:
 - .1 Indicate door types, sizes, core construction, transom panel construction, locations, swings, undercuts, hardware locations and preparation requirements, blocking for hardware in mineral core doors, fire ratings, finishes, glass, and other pertinent data.
- .4 Samples:
 - .1 Submit one 300 x 300 mm corner sample of each type of wood door.
 - .2 Show door construction, faces, core, and glazing detail representative of specified door types.
 - .3 Submit pre-finished veneer sample illustrating colour of specified door faces.

- .5 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 QUALITY ASSURANCE

- .1 Perform work to custom grade in accordance with requirements of AWMAC Architectural Woodwork Standards.
- .2 Manufacturer qualifications:
 - .1 Specialist in products specified with documented experience.
 - .2 Member in good standing with AWMAC.

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 Deliver, store, protect, and handle products in compliance with AWMAC Architectural Woodwork Standards.
- .3 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .4 Arrange for delivery after work causing abnormal humidity has been completed.
- .5 Accept doors on site in manufacturer's packaging. Inspect for damage.
- .6 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 doors away from direct sunlight.
 - .3 Store and protect products from damage.
 - .4 Replace defective or damaged materials with new.

Part 2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Wood fire rated doors:
 - .1 Provide doors tested in compliance with CAN/ULC S104 or NFPA 252.
 - .2 Provide doors with ULC or ITS/Warnock Hersey label.
- .2 Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.
- .3 Provide fire-rated wood doors with either ULC or ITS/Warnock Hersey label, and of the construction standard to the door manufacturer and conform to the requirements of manufacturer's labelling agency.

2.2 MATERIALS

- .1 Ensure products contain no added urea formaldehyde resins and adhesives.

2.3 FIRE RATED WOOD DOORS

- .1 Tested in accordance with CAN/ULC S104 or NFPA 252 to achieve rating as scheduled.
- .2 Solid core: To CAN/CSA O132.2, stile and rail frame, 5-ply construction.
 - .1 Core for 45-minute rated doors: Mineral.
- .3 Stiles and rails: Manufacturer's standard, conforming to requirements of manufacturer's labelling agency.
- .4 Face Panels:
 - .1 Hardwood; veneer grades: Grade II (Good), Maple / Birch species.
 - .2 Faces intended for transparent finish: A - custom Grade, Rift Cut, Maple / Birch, Center Balance, Match.
 - .3 Faces intended for opaque finish: high density fibreboard (HDF).
 - .4 Hardboard: composition face.
- .5 Edges: Square.
- .6 Adhesive: Type II (water resistant) for interior doors.

2.4 NON-RATED WOOD FLUSH DOORS

- .1 Manufacture doors to ANSI/WDMA I.S. 1a, Heavy Duty performance level.
- .2 Hollow core: To CAN/CSA O132.2.
 - .1 Construction: cellular core with lock blocks.
- .3 Face Panels:
 - .1 Faces of doors for opaque finish: high density fibreboard (HDF).
- .4 Edges: Square.
- .5 Adhesive: Type II (water resistant) for interior doors.

2.5 CLOSET SWING DOORS

- .1 Hollow core: To CAN/CSA O132.2.
 - .1 Construction: cellular core with lock blocks.
- .2 Face Panels:
 - .1 Faces of doors for opaque finish: high density fibreboard (HDF).
- .3 Edges: Square.
- .4 Adhesive: Type II (water resistant) for interior doors.

2.6 FABRICATION

- .1 Vertical edge strips to match face veneer.

- .2 Prepare doors to receive viewers as indicated in hardware schedule and Section 08 71 00 - Door Hardware.

Part 3 Execution

3.1 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.

3.2 INSTALLATION

- .1 Unwrap and protect doors in accordance with CAN/CSA O132.2 Series.
- .2 Install labelled fire rated doors to NFPA 80.
- .3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA O132.2 Series.
- .4 Adjust hardware for correct function.

3.3 ADJUSTMENT

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .3 Remove traces of primer and caulking; clean doors and frames.
- .4 On completion of installation, remove surplus materials, rubbish, tools, and equipment barriers.
- .5 Leave Work area clean at end of each day.
- .6 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .7 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Air and Vapour Barriers
- .2 Section 08 08 00 - Commissioning of Openings
- .3 Section 08 71 00 - Door Hardware

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 12.8-97, Insulating Glass Units
- .2 CSA Group:
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights
 - .2 CAN/CSA A440.2:19, Fenestration energy performance
 - .3 CSA A440.4:19, Window, Door, and Skylight Installation
 - .4 CSA A440S1:19, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-17, North American Fenestration Standard/Specification for Windows, Doors, and Skylights
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Submit manufacturer's printed product literature, specifications, and datasheet. Include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop drawings:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Indicate each type of door, material, thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware, fire ratings, and finishes.
 - .3 Indicate each type of frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, fire rating, and finishes.

- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .4 Samples:
 - .1 Submit one 200 x 200 mm corner sample of each type of fibreglass door.
 - .2 Show door construction, faces, core, and glazing detail representative of specified door types.
- .5 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 08 08 00 - Commissioning of Openings.
- .7 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .8 Closeout Submittals: Provide maintenance data for incorporation into O&M manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Single source supplier: All fibreglass doors by same manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with the manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.
- .4 Store door assemblies on end.
- .5 Acclimate doors and frames to site conditions for a minimum of 24 hours before installation.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 All door systems in accordance with North American Fenestration Standards (NAFS) and AAMA/WDMA/CSA 101/I.S.2/A440 and CSA A440S1, supplemented as follows.
 - .1 U-Value: To CSA/CAN A440.2, 1.25 W/sq. m/°C.
 - .2 Performance Class: LC 40.
 - .3 Minimum Performance Grade (PG): 35.
 - .4 Minimum Positive Design Pressure: 1440 Pa.
 - .5 Minimum Negative Design Pressure: -1440 Pa.
 - .6 Minimum Water Test Pressure: 220 Pa.
 - .7 Minimum Canadian Air Infiltration / Exfiltration : A3.
 - .8 Forced Entry : Pass

2.2 FIBREGLASS DOORS

- .1 Door Frame:
 - .1 Tubular / closed back 117 mm (4 5/8 inches).
 - .2 Pultruded fiberglass: Minimum thickness of 2.3 mm (0.090 inch), minimum glass content of 60%.
 - .3 Frame depth: 117 mm (4 5/8 inches).
 - .4 Insulation, frames, and sash: EPS - density 20.
 - .5 Frame Corners: Mitered, joined and sealed with molded reinforced polymer corner key and mechanically secured with screws and silicone.
 - .6 Joints: factory sealed with silicone.
- .2 Weather-stripping:
 - .1 Proud-edge low-wick foam weatherstrip in nylon jacket on door jambs, sill, and header.
- .3 Door panel:
 - .1 Fiberglass skin.
 - .2 Panel thickness: 44 mm (1 3/4").
 - .3 Finish: Smooth surface, pre-finished.
 - .4 Interior void: polyurethane foam, R14.
 - .5 Edge: rot, water, & insect resistant.
- .4 Sill:
 - .1 Sub sill: composite material, rot- and insect-proof.
 - .2 Aluminum threshold: Thermally broken, anti-slip ribbing, low profile.
 - .1 Standard mill finish. as recommended by manufacturer.
- .5 Hinges and strikes:

- .1 Hinges: stainless steel 102 x 102 mm (4" x 4") hinge with plated ball bearings. Back-up plates.
- .2 Strikes: factory installed stainless steel strike plates for latch and deadbolt.
- .6 Drilling:
 - .1 Prepare doors for commercial hardware as specified in Section 08 71 00 Door Hardware.
- .7 Glazing:
 - .1 Insulating Glass: To CAN/CGSB 12.8 triple pane.
 - .1 Panes: tempered, thickness manufacturer's standard to meet performance requirements, minimum 4 mm.
 - .2 Krypton/argon filled cavities.
 - .3 Total unit thickness: minimum 41 mm (1 5/8 inch).
 - .4 Spacers: low conductivity.
 - .2 Low E coating: as indicated.
 - .3 Seal: two-stage.
 - .1 Primary Seal: polyisobutylene (PIB) sealing compound between glass and stainless-steel spacer/separator.
 - .2 Secondary Seal: silicone-based sealant, filling gap between two lites at edge up to the spacer/separator and primary seal.
 - .4 Spacer/separator to provide continuous air barrier between interior of sealed unit and secondary seal.
 - .5 Factory glazing method: Laid-in, polyethylene closed cell adhesive tape on exterior fixed stop, locked in from the interior.
- .8 Finish:
 - .1 Frames and panels: factory applied isocynate-free two-part polymer enamel. Minimum thickness of 1.5 mm, medium gloss of 20-55.
 - .2 Standard colours to match trim, as selected by DCC Representative.
- .9 Fasteners: Concealed.
 - .1 Stainless steel or Galvanized.
- .10 Flashing: 24-gauge pre-finished metal, finish to match exposed frame.
- .11 Fenestration Tape: Refer to Section 07 25 00 – Air and Vapour Barriers.
- .12 Accessories: Standard accessories by manufacturer.

2.3 DOOR HARDWARE

- .1 Provided by door manufacturer with exception of locksets.
 - .1 Locksets: refer to 08 71 00 Door Hardware.

2.4 FABRICATION

- .1 Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 and CSA A440S1, supplemented as follows:
 - .1 Make profiles sharp, straight, and free of defects or deformations.
 - .2 Accurately fit joints; make joints flush, hairline, and weatherproof.
 - .3 Reinforce mechanically-joined corners to produce sturdy frames.
 - .4 Provide structural steel reinforcement as required.
 - .5 Provide means to drain water passing joints, condensation within framing members, and moisture migrating within system, to exterior.
 - .6 Provide thermal isolation of glazing from framing members.
 - .7 Accommodate for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - .8 Conceal fasteners, anchors, and connection devices from view to greatest extent possible.
- .2 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.
 - .1 Provide for field replacement of glazing.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install door opening assemblies in accordance with approved shop drawings, CSA A440.4, and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
- .2 Coordinate installation of thermal insulation at shim spaces at frame perimeter.
- .3 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .4 Fill gaps between rough openings and frames with low pressure build spray applied polyurethane foam.
- .5 Caulk perimeter of frames between frame and adjacent material.

- .6 Maintain continuity of air and vapour barrier.
- .7 Door hardware: Section 08 71 00.
 - .1 Install door hardware in accordance with manufacturer's printed instructions, using through-bolts to secure surface applied hardware.
 - .2 Hinges: Install on site shim behind each hinge before driving long screws provided through each hinge and into framing.
 - .3 Strikes: Install on site shim behind each strike plate before driving long screw provided through strike plate and into framing.
- .8 Site Tolerances: Maintain plumb and level tolerances specified in manufacturer's printed installation instructions.

3.3 ADJUSTING

- .1 Adjust hardware for smooth operation and secure weathertight closure.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
 - .1 Remove temporary labels and decals.
 - .2 Clean soiled surfaces and glass using a mild non-abrasive detergent and warm water solution with soft, clean cloths, prior to final acceptance.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 National Fire Protection Association (NFPA):
 - .1 NFPA 80-2013, Standard for Fire Doors and Other Opening Protectives
- .2 ULC Standards
 - .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies

1.2 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 access door components; include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings: Submit catalogue details for each type of door illustrating profiles, dimensions, and methods of assembly. Indicate location and details of installation.

1.3 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: Submit operation and maintenance data for incorporation into O&M manual.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate placement of access panels with mechanical, electrical, and plumbing trades.
- .2 Confirm placement of access panels with DCC Representative before installation.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 ACCESS PANELS

- .1 Components:
 - .1 Frame: Steel sheet, galvanized, minimum 1.6 mm (16 gauge) thick, with flange for installation to gypsum board substrate, and rounded safety corners.
 - .1 Weld exposed joints in flange and grind smooth.
 - .2 Door: Steel sheet, galvanized, minimum 1.6 mm thick, reinforced to maintain flat surface.
 - .3 Hinge: Continuous steel with pin hinge or concealed, spring hinge, with 175° swing.
 - .4 Lock: Flush, screwdriver operated cam lock.
 - .5 Finish: Powder coat prime paint.
 - .6 Rated access panels: For fire rated wall assemblies, provide access panels complying NFPA 80 or CAN/ULC-S104, with insulated sandwich-type construction.
- .2 Fabrication:
 - .1 Fabricate components straight, square, and flat, with slightly rounded exposed edges.
 - .2 Ensure products are without burrs, snags, and sharp edges.
 - .3 Exposed welds continuous and ground smooth.
 - .4 Provide anchors or make provisions in frame for anchorage to adjacent construction. Provide size, number, and location of anchors on all sides to secure access panel in opening.
- .3 Sizes: 305 x 305 mm, unless indicated otherwise in Drawings.

2.2 FINISH

- .1 Refer to Section 09 91 00 – Painting.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for access panel installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.

- .2 Inform DCC Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Follow manufacturer's instructions for installation of access panels.
- .2 Locate access doors within view of equipment and ensure equipment is accessible for operating, inspecting, adjusting, servicing without using special tools.
- .3 Install panels level, plumb, and straight.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 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 REFERENCE STANDARDS

- .1 ASTM International:
 - .1 ASTM E119-22, Standard Test Methods for Fire Tests of Building Construction and Materials
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .3 National Fire Protection Association (NFPA):
 - .1 NFPA (Fire) 288-2021, Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance - Rated Assemblies, 2022 Edition

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for attic hatches; include product characteristics, performance criteria, physical size, finish, and limitations.
 - .3 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.
 - .3 Indicate layout, details, connections, joints, finish system, installation sequence, including interface with other components.
- .4 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 08 08 00 - Commissioning of Openings.

1.3 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: Submit operation and maintenance data for incorporation into O&M manual.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate placement of attic hatches with mechanical, electrical, and plumbing trades.

- .2 Confirm placement of attic hatches with DCC Representative before installation.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Material and Equipment.
- .2 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 access doors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 ATTIC HATCHES

- .1 Attic hatches: up-swing, box-style units, pre-fabricated, with insulation fill.
 - .1 Fire resistance to ASTM E119 and NFPA 288, 60 minutes, ceiling.
 - .2 Material: Steel or stainless steel.
 - .3 Door: 1.59 mm (16-gauge), flush to frame with reinforced edges
 - .4 Insulation: 50 mm (2") thick mineral wool.
 - .5 Mounting Frame: 1.59 mm (16-gauge) mounting frame, with trim 25 mm (1") wide.
 - .6 Hinge: Concealed with coil spring for dampening.
 - .7 Size: Custom 915 x 915 mm (36 x 36 inches).
 - .8 Standard Latches: L Handle - operable from both sides.
 - .9 Locking Requirements: Keyed lock, operable from both sides.
 - .10 Gasketing: Manufacturer's standard. EPDM or neoprene.
 - .11 Finish: Steel: 5 stage iron phosphate preparation with prime coat of white baked-on enamel. Stainless Steel: Type 304 - #4 satin polish.
- .2 Finish: Refer to Section 09 91 00 – Painting.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for attic hatches installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.

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

3.2 INSTALLATION

- .1 Follow manufacturer's instructions for installation of attic hatches.
- .2 Locate attic hatches as indicated.
- .3 Install attic hatches level, plumb, and straight.

3.3 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 08 08 00 - Commissioning of Openings

1.2 REFERENCES

- .1 American Architectural Manufacturers Association (AAMA):
 - .1 AAMA 503 -14: Field Testing of Newly Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
 - .2 AAMA TIR-A8-16, Structural Performance of Composite Thermal Barrier Framing Systems
- .2 ASTM International:
 - .1 ASTM B221-21, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - .2 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants
 - .3 ASTM D412-16(2021), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers — Tension
 - .4 ASTM D570-22, Standard Test Method for Water Absorption of Plastics
 - .5 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting
 - .6 ASTM D2240-15(2021), Standard Test Method for Rubber Property - Durometer Hardness
 - .7 ASTM E96/E96M-16, Standard Test Method for Water Vapor Transmission of Materials
 - .8 ASTM E154/E154M-08a (2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
- .3 CSA Group:
 - .1 CSA AAMA/WDMA/CSA 101/I.S.2/A440:22, NAFS – North American Fenestration Standard / Specification for windows, doors, and skylights, Includes Errata (2023)
 - .2 CSA O141:05, Softwood Lumber
 - .3 CAN/CSA W59.2-18, Welded Aluminum Construction
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .5 National Lumber Grading Authority (NLGA):
 - .1 NLGA Standard Grading Rules for Canadian Lumber, 2017

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Submit manufacturer's printed product literature, specifications, and datasheets.
 - .3 Provide construction details, material description, component dimensions, and profiles, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details, finishes and limitations.
 - .4 Submit WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Design aluminum storefront systems, including comprehensive engineering analysis by a qualified professional engineer licenced in the Province of Ontario, using performance requirements and design criteria indicated.
 - .3 Include aluminum-framed storefront panel and component dimensions, framed opening requirements and tolerances, adjacent construction, anchor details, anticipated deflection under load, weep drainage network, expansion and contraction joint location and details, and field welding required.
 - .4 Include details of fasteners between interior and exterior extrusions ensuring no penetration of thermal break or thermal bridging.
 - .5 Show size and location of seismic restraints. Include seismic design calculations.
- .4 Field Measurements: Verify actual dimensions of aluminum framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 All storefront systems in accordance with North American Fenestration Standards (NAFS) and AAMA/WDMA/CSA 101/I.S.2/A440, supplemented as follows.
 - .1 Performance Class: AW.
 - .2 Minimum Performance Grade (PG): 40.
 - .3 U-Factor: 1.14.
 - .4 Minimum Positive Design Pressure: 1920 Pa.
 - .5 Minimum Negative Design Pressure: -1920 Pa.
 - .6 Minimum Water Penetration Resistance Test Pressure: 390 Pa.
 - .7 Minimum Canadian Air Infiltration / Exfiltration : A2.
- .2 Thermal Movements:
 - .1 Allow for thermal movements resulting from the following:
 - .1 -35 C to +35 C maximum change (range) in ambient and surface temperatures
 - .2 24 C test interior ambient air temperature.
- .3 Allow for movement between system and perimeter framing components or substrate.

2.2 MATERIALS

- .1 Aluminum Extrusions:
 - .1 Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish.
 - .2 Not less than 1.8 mm (0.070 inch) wall thickness at any location for the main frame
 - .3 Complying with ASTM B221: 6063-T6 alloy and temper
- .2 Fasteners:
 - .1 Aluminum, nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.
- .3 Anchors, Clips, and Accessories:
 - .1 Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.
- .4 Reinforcing Members:
 - .1 Reinforcing members must provide sufficient strength to withstand the design pressure indicated.
- .5 Sealant:

- .1 For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- .6 Tolerances:
 - .1 References to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 STOREFRONT FRAMING SYSTEM

- .1 Thermal Barrier:
 - .1 Thermal break with two (2) 6.4 mm (1/4") separations consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
 - .2 Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
- .2 Brackets and Reinforcements:
 - .1 Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.
- .3 Fasteners and Accessories:
 - .1 Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials. Where exposed, fasteners and accessories shall be stainless steel.
- .4 Perimeter Anchors:
 - .1 When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

2.4 GLAZING

- .1 Insulating glass units: Refer to Section 08 80 00 – Glazing.
- .2 Glazing Gaskets:
 - .1 Manufacturer's standard compression types.
 - .2 Replaceable, extruded EPDM rubber.
- .3 Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- .4 Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- .5 Glazing sealants as recommended by manufacturer for joint type, and as follows:
 - .1 Weather sealant:
 - .1 ASTM C920 for Type S, Grade NS, Class 25, Uses NT, G, A, O.

- .2 Single-component neutral-curing formulation that is compatible with the structural sealant and other system components with which it comes in contact.
- .3 Recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
- .4 Color: Matching structural sealant.

2.5 ENTRANCE DOOR SYSTEMS

- .1 Provide manufacturer's recommended and system-appropriate doors.

2.6 HARDWARE

- .1 Provide manufacturer's standard weather strip and sweep to achieve air and water infiltration performance requirements.
- .2 Hinges: Manufacturer's standard butt hinges.
- .3 Other door hardware: Refer to Section 08 71 00 – Door Hardware.

2.7 ACCESSORIES

- .1 Through-wall membrane flashing: Purpose-made, self-adhering sheet, composed of SBS modified asphalt laminated to engineered polyethylene film. Provide substrate primer as recommended by membrane manufacturer.
 - .1 Thickness: Nominal 1 mm (40 mil).
 - .2 Service temperature: -40°C to 70°C.
 - .3 Elongation (ASTM D412 Die C): 200% minimum.
 - .4 Tensile strength – film (ASTM D882): 4.1 N/mm (23.5 lb/in) minimum.
 - .5 Puncture resistance (ASTM E154): 178 N (40 lbf).
 - .6 Water vapour permeance (ASTM E96 Method B): 1.9 ng/Pa·s·m² (0.035 perms).
 - .7 Moisture absorption (ASTM D570): 0.1% maximum.
- .2 Wood blocking: Softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 Dimension sizes: "Standard" light framing or better grade.
- .3 Flashings: Pre-finished metal, refer to Section 07 62 00.
- .4 Gasketing: Extruded EPDM gaskets.
- .5 Setting Blocks: To ASTM D2240, neoprene, EPDM, or silicone; 80-90 Shore A Durometer hardness.

- .6 Spacers: To ASTM D2240, neoprene, EPDM, or silicone; 50-60 Shore A Durometer hardness.
- .7 Sealants: Structural silicone - refer to Section 07 92 00.
- .8 Sealant Bond Breaker: Open cell foam backer rod sized to suit project requirements.
- .9 Isolation coating: Cold-applied, bituminous paint, asbestos free, 0.76 mm (30 mil) per coat.

2.8 FABRICATION

- .1 Perform aluminum welding to CAN/CSA W59.2.
- .2 Aluminum-Framed Storefront System Fabrication:
 - .1 Fabricate aluminum assemblies of extruded sections to sizes and profiles indicated.
 - .1 Ensure verticals and horizontals are extrusions designed for shear block or screw spline construction.
 - .2 Construct units square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
 - .3 Provide complete separation of interior and exterior components of framing system by means of extruded thermoplastic structural thermal break.
- .3 Aluminum Framed Door Fabrication:
 - .1 Doors: Aluminum-framed swing doors with glass insert suitable for inclusion in aluminum-framed storefront system, constructed and finished to match storefront.
 - .2 Perform aluminum welding to CAN/CSA W59.2.
 - .3 Fabricate aluminum assemblies of extruded sections to sizes and profiles indicated.
 - .4 Design stiles and rails for mechanical shear block fastening in combination with plug welds and fillet welds at stile/rail connections.
 - .5 Provide complete separation of interior and exterior components of door leaf by means of extruded thermoplastic structural thermal break.
 - .6 Construct doors square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
 - .7 Accurately fit and secure joints and corners.
 - .1 Ensure joints are flush and hairline.
 - .8 Use only concealed or semi-concealed fasteners.
 - .1 Where fasteners cannot be concealed, countersunk screws finished to match adjacent material may be used.
 - .9 Install door hardware.
 - .10 Locate manufacturer's labels on exterior side of door bottom rail.

2.9 ALUMINUM FINISHES

- .1 Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable for aluminum-framed entrance and storefront installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install aluminum-framed storefront in accordance with manufacturer's written instructions.
- .2 Perform aluminum welding to CAN/CSA W59.2.
- .3 Attach thermally broken aluminum-framed storefront assemblies to structure plumb and level, free from warp, and allow for sufficient adjustment to accommodate construction tolerances and other irregularities.
 - .1 Maintain dimensional tolerances and align with adjacent work.
 - .2 Use alignment attachments and shims to permanently fasten elements to building structure.
 - .3 Clean welded surfaces and apply protective primer to field welds and adjacent surfaces.
- .4 Install thermal isolation where components penetrate or disrupt building insulation.
- .5 Install flashings as indicated.
- .6 Separate incompatible materials from corrosion and galvanic action with isolation coating, 0.76 mm (30 mil) coating thickness.
 - .1 Isolate aluminum from concrete.
- .7 Install low pressure expanding foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .8 Install insulating glass units in accordance with manufacturer's written instructions.

- .9 Install perimeter sealant to method required to achieve performance criteria, backing materials, and installation criteria in accordance with Section 07 92 00 - Joint Sealing.

3.3 FIELD QUALITY CONTROL

- .1 Field Tests:
 - .1 DCC Representative shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
 - .2 Conduct tests for air infiltration and water penetration with manufacturer's representative present.
 - .3 Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.
 - .4 Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
 - .5 Refer to Section 07 08 00 - Commissioning of Thermal and Moisture Protection for air and water infiltration tests.

3.4 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Remove protective material from pre-finished aluminum surfaces.
- .4 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- .5 Remove excess sealant by method acceptable to sealant manufacturer.
- .6 Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions. Remove construction debris from project site and legally dispose of debris.
- .7 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .8 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION OF FINISHED WORK

- .1 Protect installed product's finish surfaces from damage during construction. Protect aluminum entrances from damage from grinding and polishing

compounds, plaster, lime, acid, cement, or other harmful contaminants. Remove and replace damaged aluminum entrances at no extra cost.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Air and Vapour Barriers
- .2 Section 07 92 00 - Joint Sealants
- .3 Section 08 08 00 - Commissioning of Openings

1.2 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.8-97, Insulating glass units
 - .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings
- .2 CSA Group:
 - .1 CSA AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS – North American Fenestration Standard / Specification for windows, doors, and skylights, Includes Errata
 - .2 CSA-A440S1:19 – Canadian Supplement to AAMA/WDMA/CSA/101/I.S.2/A440S1-17 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights
 - .3 CAN/CSA A440.4:19, Window, Door, and Skylight Installation

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for windows; include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .3 Submit two copies of WHMIS Safety Data Sheets (SDS).
- .3 Shop Drawings:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Indicate materials and details in full size scale, showing window dimensions, elevations, sections, details, attachments to other work, and installation details.
 - .1 Demonstrate continuity of air barrier.
 - .2 Interior trim and exterior junctions with adjacent construction.
 - .3 Core thicknesses of components.

- .4 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
 - .5 Arrangement of reinforcing for hardware and joints.
 - .6 Arrangement of hardware and required clearances.
 - .7 Location of caulking.
- .4 Samples: Submit duplicate samples of vertical-to-horizontal intersection of frame system, minimum size 200 x 200 mm, showing:
 - .1 Profiles, colour, glazing stop, door stop, finish.
 - .2 Joinery, including concealed welds.
 - .3 Anchorage.
 - .4 Expansion provisions.
 - .5 Flashing and drainage.
- .5 Test and Evaluation Reports: Submit test reports from approved independent testing laboratories, certifying compliance with performance requirements of this section.
- .6 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 08 08 00 - Commissioning of Openings.
- .7 Certifications: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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 cleaning and maintenance of frame finishes, for incorporation into manual.

1.5 QUALITY ASSURANCE

- .1 Single source supplier: All vinyl windows by same manufacturer.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
 - .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Use coatings that are easily removed and residue free.
 - .2 Leave protective covering in place until final cleaning of building.

- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install sealants when ambient temperature is less than 5°C (40°F).
- .2 Maintain this minimum temperature during and after installation of sealants.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Insulating Glass Units in accordance with CAN/CGSB-12.8. Units to be certified by the Insulated Glass Manufacturers Alliance (IGMA). Overall unit thickness and glass pane thicknesses to be in accordance with the applicable building code.
- .2 All vinyl windows in accordance with North American Fenestration Standards (NAFS) and AAMA/WDMA/CSA 101/I.S.2/A440, supplemented as follows.
 - .1 Fixed:
 - .1 Overall U-Value: Maximum 0.76 W/(m²·K).
 - .2 Performance Class: CW.
 - .3 Performance Grade (PG): 30.
 - .4 Minimum Positive Design Pressure: 1400 Pa.
 - .5 Minimum Negative Design Pressure : -1400Pa.
 - .6 Water Penetration Resistance: 220 Pa.
 - .7 Minimum Canadian Air Infiltration / Exfiltration : A3.
 - .8 Forced Entry Resistance: Grade 40.
 - .9 Vinyl frames meeting specified performance and design requirements are acceptable.
 - .2 Awning:
 - .1 Overall U-Value: Maximum 0.83 W/(m²·K).
 - .2 Performance Class: CW.
 - .3 Performance Grade (PG): 30.
 - .4 Minimum Positive Design Pressure: 1440 Pa.
 - .5 Minimum Negative Design Pressure: -1440 Pa.
 - .6 Water Penetration Resistance: 220 Pa.
 - .7 Minimum Canadian Air Infiltration / Exfiltration : A2.
 - .8 Forced Entry Resistance: Grade 10.

- .9 Vinyl frames meeting specified performance and design requirements are acceptable.
- .3 Windows to minimize water penetrating window joints, cavities, & channels based on rainscreen principles and designed to naturally drain to exterior and out, through a weep drainage system.
- .4 Deflection limit of framing members: L/175.
- .3 Provide anchorage capable of withstanding wind load design in accordance with National Building Code.
- .4 Design to accommodate expansion and contraction within service temperature range of -35°C to 35°C.
- .5 Allow for movement between system and perimeter framing components or substrate.
- .6 Glazing: Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.

2.2 VINYL WINDOWS

- .1 All vinyl windows by same manufacturer.
- .2 Fixed Windows:
 - .1 Triple Glazed, 35 mm (1 3/8 inch).
 - .2 Low E : as indicated.
 - .3 Gaps: 13 mm (1/2 inch) argon filled.
- .3 Awning Windows:
 - .1 Triple Glazed, 35 mm (1 3/8 inch).
 - .2 Low E : as indicated.
 - .3 Gaps: 13 mm (1/2 inch) argon filled.
- .4 Frames: to CSA A440/A440.1, extruded tubular plastic sections, factory fabricated.
 - .1 Main frame: Vinyl, thermally broken, hollow tubular sections of polyvinyl chloride (PVC).
 - .2 Frame cavities: with foam insulation, EPS - Density 20.
 - .3 Frame Corners: Mitered, joined and sealed with molded reinforced polymer corner key and mechanically secured with screws and silicone.
 - .4 Joints: factory sealed with silicone.
 - .5 Non-structural accessory members: vinyl or aluminum as indicated.
- .5 Weather-stripping:
 - .1 Triple-weatherstripping, EPDM closed-cell sponge rubber, black, applied continuously around corners.

- .6 Glazing:
 - .1 Insulating Glass: To CAN2-12.8M triple pane.
 - .1 Panes: tempered, minimum 3 mm.
 - .2 Argon filled 13 mm cavities.
 - .3 Total unit thickness: minimum 35 mm (1 3/8 inch).
 - .4 Spacers: low conductivity.
 - .2 Low E coating: as indicated.
 - .3 Seal: two-stage.
 - .1 Primary Seal: polyisobutylene (PIB) sealing compound between glass and stainless-steel spacer/separator.
 - .2 Secondary Seal: silicone-based sealant, filling gap between two lites at edge up to the spacer/separator and primary seal.
 - .4 Spacer/separator to provide continuous air barrier between interior of sealed unit and secondary seal.
 - .5 Factory glazing method: Laid-in, polyethylene closed cell adhesive tape on exterior fixed stop, locked in from the interior.
- .7 Grids:
 - .1 Internal grids: prefinished aluminum or PVC.
 - .1 Dimensions as indicated.
 - .2 Profile and colour as selected by DCC Representative from manufacturer's full range.
- .8 Insect Screens:
 - .1 Heavy duty extruded aluminum frame with fiberglass mesh and adjustable steel tandem rollers. Colour to match window frame.
 - .2 Heavy duty screen mesh in black, non-glare fiberglass cloth, mesh count 18 x 14, held in place by spline but removable. Mounted on interior ventilating portion of window.
- .9 Hardware:
 - .1 Concealed E-Gard coated heavy gauge steel hinge, stainless steel track, roto gear operators with collapsible handles, snubbers and sequentially locking multi-point locks.
 - .2 Installation: mechanical fasteners.
 - .3 Limit devices on operators, 100mm, as required.
- .10 Finish:
 - .1 Frames: factory applied isocyanate-free two-part polymer enamel. Minimum thickness of 1.5 mm, medium gloss of 20-55.
 - .2 Standard colours to match trim, as selected by DCC Representative.
- .11 Fasteners: Concealed.
 - .1 Stainless steel or Galvanized.

- .12 Flashing: 24-gauge pre-finished metal, finish to match adjacent siding.
- .13 Fenestration Tape: Refer to Section 07 25 00 - Air and Vapour Barriers.
- .14 Accessories: Standard accessories by manufacturer.
- .15 Oversized Unit Reinforcement: Fiberglass or steel plates as required.

2.3 FABRICATION

- .1 Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, supplemented as follows:
 - .1 Make profiles sharp, straight, and free of defects or deformations.
 - .2 Accurately fit joints; make joints flush, hairline, and weatherproof.
 - .3 Reinforce mechanically joined corners to produce sturdy frames.
 - .4 Provide structural steel reinforcement as required.
 - .5 Provide means to drain water passing joints, condensation within framing members, and moisture migrating within system, to exterior.
 - .6 Provide thermal isolation of glazing from framing members.
 - .7 Accommodate for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
- .2 Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
- .3 Form sills and stools in one piece. Slope sills for wash.
- .4 Form snap-in glass stops, closure moulds, weather stops, and flashings of extruded PVC for tight fit into window frame section.
- .5 Form weather stop flange to perimeter of unit.
- .6 Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- .7 Conceal fasteners, anchors, and connection devices from view to greatest extent possible.
- .8 Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.
- .9 Assemble insect screen frame, mitre and reinforced frame corners. Fit mesh taut into frame, and secure.
- .10 Weatherstrip operable units.

- .11 Glazing:
 - .1 Factory glaze window units.
 - .2 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.
 - .1 Provide for field replacement of glazing.

2.4 FINISHES

- .1 Exterior Surfaces: Colour White.
- .2 Interior Surfaces: Colour White.
- .3 Screens: Colour Black.
- .4 Operators and Exposed Hardware: White baked enamel.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for window installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install windows in accordance with CAN/CSA A440.4.
- .2 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .3 Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- .4 Install windows and components to drain condensation, water penetrating joints, and moisture migrating within system to exterior.
- .5 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.
- .6 Seal joints to provide weathertight seal at outside and air seal at inside.

- .7 Provide low expanding polyurethane foam sealant installed at head and jamb perimeter of window frame for sealing to building air and vapour barrier. Apply sufficient width of foam sealant to provide air tightness and vapour diffusion control to building air barrier and vapour barrier from interior.
- .8 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within framing except where exposed use is permitted by DCC Representative.

3.3 ADJUSTING

- .1 Adjust hardware for smooth operation and secure weathertight closure.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
 - .2 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.
 - .3 Clean glass and glazing materials with approved non-abrasive cleaner.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
 - .1 Remove temporary labels and decals.
 - .2 Clean soiled surfaces and glass using a mild non-abrasive detergent and warm water solution with soft, clean cloths, prior to final acceptance.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA):
 - .1 ANSI/BHMA A156.1-2021, Butts and Hinges
 - .2 ANSI/BHMA A156.2-2022, Bored and Preassembled Locks and Latches
 - .3 ANSI/BHMA A156.4-2024, Door Controls - Closers
 - .4 ANSI/BHMA A156.6-2021, Architectural Door Trim
 - .5 ANSI/BHMA A156.8-2021, Door Controls – Overhead Stops and Holders
 - .6 ANSI/BHMA A156.16-2023, Auxiliary Hardware
 - .7 ANSI/BHMA A156.22-2021, Door Gasketing and Edge Seal Systems
 - .8 ANSI/GHMA A156.36-2020, Auxiliary Locks.
- .2 CSA Group:
 - .1 CSA B651-18 – Accessible Design for the Built Environment
- .3 Canadian Steel Door and Frame Manufacturers' Association (CSDMA):
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2022

1.2 SUBMITTALS

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

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 door hardware for incorporation into manual.

1.4 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.

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 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 and in accordance with manufacturer's recommendations in clean, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping or strippable coating.
 - .4 Replace defective or damaged materials with new.

1.6 WARRANTY

- .1 Provide Manufacturer's standard warranty for each type of door hardware; products to be free from manufacturer's defects for following time periods from date of substantial performance.
 - .1 Locks, deadbolts – 3 year mechanical.
 - .2 Hinges – 1 year.
 - .3 Surface closers – 10 years.
 - .4 Concealed overhead stops – 2 years.
 - .5 Other door hardware – 1 year.

Part 2 Products

2.1 GENERAL

- .1 Use one manufacturer's products only for similar items.
- .2 Finishes: as scheduled.

2.2 DOOR HARDWARE

- .1 Interior cylindrical sets, Grade 3: To ANSI A156.2, Series 4000, Grade 3, residential grade.
 - .1 Backset: 60 to 70 mm.
 - .2 Levers: L-shaped.
 - .3 Strikes: 58 mm full lip.
 - .4 Functions: as scheduled.
 - .1 Privacy, with coin-turn exterior release – ANSI F76A.
 - .2 Passage – ANSI F75.
- .2 Cylindrical locksets, Grade 1: to BHMA A156.2, Series 4000, Grade 1.
 - .1 Backset: 60 to 70 mm.
 - .2 Levers: cast zinc, L-shaped.
 - .3 Roses: wrought brass.
 - .4 Strikes: 124 x 32 x 32 mm.
 - .5 Functions: as scheduled.
 - .6 Cylinders: provide cylinders separately from locksets, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.
- .3 Deadbolts: To ANSI/BHMA A156.36, Grade 1, ANSI E2151; commercial grade, full-sized interchangeable core format cylinder, thumb turn at interior.
 - .1 Backset: 60 or 70 mm, adjustable.
 - .2 Bolt: solid zinc with hardened steel anti-saw insert.
 - .3 Throw: 25 mm minimum.
 - .4 Cylinder: 6-pin tumbler.
 - .5 Provide deadbolts from same manufacturer and product line as for corresponding locksets.
 - .6 Cylinders: provide cylinders separately from deadbolts, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.
- .4 Standard weight hinges: BHMA A156.1 and ANSI A8112; five-knuckle; ball bearings; 3.4 mm (0.134 gauge) steel, 8 holes/set.
- .5 Surface closers: BHMA A156.4, Grade 1; rack-and-pinion style; cast aluminum body; adjustable closing speed, latching speed, and backcheck; high impact plastic cover. Include mounting plate as required.
 - .1 Arms: forged steel, non-hold open, type to suit.
- .6 Concealed overhead stops: BHMA A156.8 and ANSI C04541; standard duty, adjustable, 110° opening, slide track style; shock absorber spring.
- .7 Floor stops: BHMA A156.16, ANSI L02141, dome style, solid cast brass, heavy duty casting with solid pin; 47 mm diameter, complete with rubber bumper.

- .8 Wall-mounted door stops: Die-cast zinc spring style with PVC bumper, projection 75 mm.
- .9 Kick plates: BHMA A156.6 and ANSI J102; 1.27 mm thick stainless steel, No. 4 finish, bevelled on all edges, with pre-drilled countersunk holes.
 - .1 Height: 200 mm.
 - .2 Push side width: 50 mm less than door width.
 - .3 Pull side width: 38 mm less than door width.
- .10 Bulb gasketing: BHMA A156.22 and ANSI R0E154; silicone extrusion, compression bulb profile with stabilizer flange, 12.7 mm width, 6 mm height, adhesive backing; provide for jambs and header.
- .11 Perimeter gasketing: BHMA A156.22 and ANSI R3G164; standard duty; 19 mm wide extruded tempered aluminum retainer; with 6 mm black replaceable sponge neoprene insert; stainless steel fasteners; provide for jambs and header.
- .12 Viewers: BHMA A156.16 and ANSI L03221; brass construction with satin nickel finish, UL listed for 90 minute fire rating, one-way 190° viewing angle.
- .13 Ball Catches, at double closet doors: Mortised in top of door, spring loaded ball with adjustable tension via set screw, matching striker plate.

2.3 FASTENINGS

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

2.4 KEYING

- .1 Provide cylinders separately from Grade 1 cylindrical locks and deadbolts, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.

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 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 CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction) and CSA B651.
- .5 Where doorstop contacts door pulls, mount stop to strike bottom of pull.
- .6 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

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 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .3 Remove protective material from hardware items where present.
 - .4 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

3.4 PROTECTION

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

3.5 HARDWARE SCHEDULE

Set: 1.0 – Suite Washroom / Master Bdrm

3	Hinges	3 ½" x 3 ½" R5/8" A2184 By Door Supplier	652
1	Privacy Set	ANSI F76A Grade 3 Cylindrical	626
1	Stop	Type to Suit L02051/L02223	652

Notes: Cylinders: Provide cylinders separately from locksets, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.

Set: 2.0 – Interior Suite Typ. HCHB

3	Hinges	3 ½" x 3 ½" R5/8" A2184 By Door Supplier	652
1	Passage Set	ANSI F75 Grade 3 Cylindrical	626
1	Stop	Type to Suit L02051/L02223	652

Set: 3.0 – Stairwell / Common Doors

3	Hinge, Full Mortise	ANSI 156.1 A8112 4-1/2" x 4"	652
1	Passage Set	ANSI F75 Grade 1 Cylindrical	626
1	Overhead Stop, Concealed	ANSI BHMA 156.8 C01541	652
1	Surface Closer	ANSI 156.4 Regular Arm Mount C02011	689
1	Kick Plate	ANSI 156.6 J102 0.50" 10" x 1 1/4" LDW CSK BEV	630
1	Perimeter Gasketing	Concealed, Heavy Duty	

Notes: Cylinders: provide cylinders separately from locksets, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.

Set: 4.0 – M/E Rooms

3	Hinge, Full Mortise	ANSI 156.1 A8112 4-1/2" x 4"	652
1	Storeroom Lock	ANSI F86 Grade 1 Cylindrical	626
1	Surface Closer	ANSI 156.4 Regular Arm Mount C02011	689
1	Kick Plate	ANSI 156.6 J102.050" 10" x 1 1/4" LDW CSK BEV	630
1	Floor Stop	ANSI 156.16 L02141	626

Notes: Cylinders: provide cylinders separately from locksets, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.

Set: 5.0 – Suite Entry (Interior)

3	Hinge, Full Mortise	ANSI 156.1 A8112 4-1/2" x 4"	652
1	Passage Set	ANSI F75 Grade 1 Cylindrical	626
1	Deadbolt	ANSI E0151 Grade 1 Cylindrical	626
1	Overhead Stop, Concealed	ANSI BHMA 156.8 C01541	652
1	Surface Closer	ANSI 156.4 Regular Arm Mount C03011	689
1	Perimeter Gasketing	ANSI R0E154 To Suit Opening	BLK
1	Door Viewer	A156.16 L03221 190 Deg	646

Notes: Cylinders: provide cylinders separately from locksets and deadbolts, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.

Set: 6.0 – Dual Swing Closet doors

6	Hinges	3 1/2" x 3 1/2" R5/8" A2184 By Door Supplier	652
2	Dummy Trim	ANSI 156.2 Grade 3 Cylindrical	626
2	Stop	Type to Suit L02051/L02223	652
2	Ball Catches	5035	

Set: 7.0 – Aluminum Entrance Door

1	Continuous Hinge	ANSI 156.26 Gear Type Edge Mount	628
1	Rim Cylinder	ANSI 156-5 E09221 "C123 KKY"	626
1	Exit Device	ANSI 156.3 Type 4 F03	630
1	Electric trim, lever	ANSI 156.25 L221 FSE	626
1	Closer	ANSI 156.4 Top Mount C02041	689
1	Power Transfer	ANSI 156.3 Grade 1 Mortised	689
1	Perimeter Gasket	By Door Supplier	
1	Door Sweep	ANSI 156.22 R0Y416	628
1	Threshold	ANSI 156.21 J12190 5"	627
1	Security Astragal	ANSI 156.22 R0Y635 x Dr Height	628
1	Power Supply	By Security Contractor	

Intercom and Electronic Security Components as required - By Security Contractor

Notes: Cylinders: provide cylinders separately compatible with keyway, 0-bitted, for re-keying by CFHA locksmith

Set: 8.0 – Attic Access Doors

3	Spring Hinge, Full Mortise	ANSI K81011 4-1/2" x 4"	652
1	Passage Set	ANSI F75 Grade 1 Cylindrical	626
1	Overhead Stop, Surface	ANSI 156.8 C05541 Std Duty	652
1	Perimeter Gasketing	ANSI R0E154 To Suit Opening	BLK

Set: 9.0 – Suite Entry (Balcony)

3	Hinge, Full Mortise	By Door Supplier	US26D
1	Passage Set	ANSI F75 Grade 3 Cylindrical	626
1	Deadbolt	ANSI E0151 Grade 1 Cylindrical	626
	Balance Of Hardware	By Door Supplier	

Notes: Cylinders: Provide cylinders separately from locksets, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.

Set: 10.0 – Reserved

Set: 11.0 – Dual (915x2035x45) Shed Doors

6	Hinge, Full Mortise	ANSI 156.1 A2112 4-1/2" x 4" NRP	626
2	Surface Bolt	ANSI 156.16 L04161 8"	626
1	Passage Set	ANSI F75 Grade 1 Cylindrical	626
1	Deadbolt	ANSI E0151 Grade 1 Cylindrical	626
2	OH Stop /Holder, Concealed	ANSI 156.8 C055331	630
1	Perimeter Gasketing	ANSI R0E154 To Suit Opening	BLK
1	Sweep / Threshold	2746x292AFGPK or sim.	
1	Security Astragal	ANSI 156.22 R0Y635 x Dr Height	628

Notes: Cylinders: provide cylinders separately from locksets and deadbolts, compatible with keyway, 0-bitted, for re-keying by CFHA locksmith.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 08 08 00 - Commissioning of Openings

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI):
 - .1 ANSI Z97.1-2015, Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
- .2 ASTM International:
 - .1 ASTM D2240-15(2021), Standard Test Method for Rubber Property - Durometer Hardness
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 12.1-2017, Safety Glazing
 - .2 CAN/CGSB 12.3-M91, Flat, Clear Float Glass
 - .3 CAN/CGSB 12.8-97, Insulating Glass Units
- .4 National Glass Association with GANA (NGA):
 - .1 GANA Glazing Manual – current edition
 - .2 NGA Laminated Glazing Reference Manual - latest online edition
- .5 ULC Standards:
 - .1 CAN/ULC S104-15, Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC S106-15, Standard Method for Fire Tests of Window and Glass Block Assemblies

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories; include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Refer to Section 08 08 00 - Commissioning of Openings.
 - .2 Shop drawings shall bear stamp and signature of a Professional Engineer licensed to design structures and registered in province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.

- .3 Show layout, profiles, and product components, including anchorage, accessories, finishes, colours, patterns.
- .4 Include detailed plans, elevations, details of framing members, sealants, fasteners, anchors, thicknesses.
- .4 Samples:
 - .1 Submit duplicate 200 x 200 mm size samples of each type of glass proposed for installation.
- .5 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

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 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.
- .2 Mock-ups:
 - .1 Provide mock-up in accordance with Section 01 43 00 - Quality Assurance and Section 08 08 00 - Commissioning of Openings.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Protect prefinished aluminum surfaces with strippable coating.
 - .4 Replace defective or damaged materials with new.

1.7 AMBIENT CONDITIONS

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

Part 2 Products

2.1 MATERIALS

- .1 Design Criteria:
 - .1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
 - .2 Size glass to withstand wind loads, dead loads, and positive and negative live loads to NBCC 2020.
 - .3 Limit glass deflection according to NBCC 2020 with full recovery of glazing materials.
- .2 Glass for aluminum railings:
 - .1 Tempered Glass; to CAN/CGSB 12.1, smoked finish to 20% opacity, glazing quality, thickness as required to meet ANSI Z97.1 Class A but not less than 6 mm thick. At locations where full-height glass panes are used (e.g., panes $\geq$ 2200 mm in height), minimum thickness to be 10 mm.
 - .2 Type: 2 tempered.
- .3 Safety glass: To CAN/CGSB 12.1, transparent, 6 mm thick.
 - .1 Type: Tempered.
- .4 Ceramic fire-rated glass: To CAN/ULC-S104 and CAN/ULC S106.
 - .1 Thickness: 5 mm.
 - .2 Fire rating: As scheduled.
 - .3 Provide glazing compounds and tapes as recommended by ceramic glass manufacturer.
- .5 Insulating Glass Units, Double: To CAN/CGSB 12.8, double unit, 25 mm overall thickness.
 - .1 Glass: to CAN/CGSB 12.1, tempered.
 - .2 Glass thickness: 6 mm each light.
 - .3 Inter-cavity space thickness: with low conductivity spacers, 13 mm between inner and outer lights.
 - .4 Glass coating: low "E" .
 - .1 SHGC: 0.41 Dual low e 272
 - .5 Inert gas fill: Argon.
- .6 Insulating Glass Units, Triple: To CAN/CGSB 12.8, triple unit, 35 mm overall thickness.
 - .1 Glass: to CAN/CGSB 12.3, CAN/CGSB 12.1.
 - .2 Glass thickness: 6 mm outer and inner lights, 4 mm middle light.
 - .3 Inter-cavity space thickness: with low conductivity spacers 10 mm between inner and middle lights, 10 mm between middle and outer lights.

- .4 Glass coating: low "E" .
 - .1 SHGC: 0.41 Dual low e 272
- .5 Inert gas fill: Argon.
- .7 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

2.2 ACCESSORIES

- .1 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .2 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape: Preformed butyl compound with integral resilient tube spacer, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; widths as required for application, black colour.
- .4 Glazing splines: Resilient polyvinyl chloride or silicone, extruded shape to suit glazing channel retaining slot, colour as selected by DCC Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for glazing installation in accordance with manufacturer's written instructions.
 - .1 Verify openings for glazing are correctly sized and within tolerance.
 - .2 Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
 - .3 Visually inspect substrate.
 - .4 Inform DCC Representative of unacceptable conditions.
 - .5 Proceed with installation only after unacceptable conditions have been remedied.

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 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)

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

- .2 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .3 Cut glazing tape or spline to length; install on glazing light. Butt-joint tape or spline and seal junctions with sealant.
- .4 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .5 Rest glass unit on setting blocks; apply pressure against fixed stop for full continuous contact.
- .6 Install removable stops without displacing glazing tape or spline. Apply pressure for full continuous contact.
- .7 Trim protruding tape edge flush with stop.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

- .1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line. Butt-joint tape edges, seal joints with butyl sealant.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glass unit on setting blocks; apply pressure against fixed stop for full contact.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Apply pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove traces of primer, caulking.
 - .2 Remove glazing materials from finish surfaces.
 - .3 Remove labels.
 - .4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.6 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 or paste.
- .3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM B69-21, Standard Specification for Rolled Zinc
 - .2 ASTM C475/C475M-17(2022), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
 - .3 ASTM C557-03(2017), Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing
 - .4 ASTM C645-24, Standard Specification for Non-Structural Steel Framing Members
 - .5 ASTM C754-18, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
 - .6 ASTM C840-18b, Standard Specification for Application and Finishing of Gypsum Board
 - .7 ASTM C919-24, Standard Practice for Use of Sealants in Acoustical Applications
 - .8 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - .9 ASTM C1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - .10 ASTM C1325-22e1, Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units
 - .11 ASTM C1396/C1396M-14, Standard Specification for Gypsum Wallboard
 - .12 ASTM E84-24, Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction
- .3 Gypsum Association (GA):
 - .1 GA-214-2021, Levels of Finish for Gypsum Panel Products
 - .2 GA-216-2021, Application and Finishing of Gypsum Panel Products
- .4 ULC Standards:
 - .1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.2 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; include product characteristics, performance criteria, physical size, finish, and limitations.

1.3 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire rated assemblies as follows:

- .1 Fire resistance classifications to CAN/ULC S102.
- .2 Fire rated Design Assembly No. as listed on Drawings.

1.4 MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 43 00 - Quality Assurance.
- .2 Construct wall assembly, full height by 1200 mm wide, illustrating materials installation and interface.
- .3 Locate where directed.
- .4 Accepted mock-up may remain as part of finished work.
- .5 Allow for inspection of mock-up by DCC Representative before proceeding with gypsum wall partition Work.

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .3 Storage and Handling Requirements:
 - .1 Store gypsum board materials level, off ground, and indoors in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board materials from nicks, scratches, and blemishes.
 - .3 Protect from weather, elements, and damage from construction operations.
 - .4 Handle gypsum boards to prevent damage to edges, ends, or surfaces.
 - .5 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
 - .6 Store and protect products from damage.
 - .7 Replace defective or damaged materials with new.

1.6 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, frost-free surfaces.
- .3 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 MATERIALS

- .1 Standard gypsum board: ASTM C1396/C1396M, regular and Type X, thickness as shown on Drawings, 1200 mm wide x maximum practical length, ends square cut, edges square.
- .2 Enhanced fire-resistant gypsum board: ASTM C1396/C1396M, Type C, thickness as shown on Drawings, 1200 mm wide x maximum practical length, ends square cut, edges.
- .3 Water-resistant board: ASTM C1396/C1396M, Type X, thickness as shown on Drawings, 1200 mm wide x maximum practical length.
- .4 Carrying Channels: Cold rolled steel to ASTM C645, galvanized.
- .5 Tie Wire: To ASTM C754.
- .6 Hangers: To ASTM C754, galvanized.
- .7 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .8 Resilient channels: To ASTM C645, 0.46 (25 ga) steel, G40, with integral pre-punched attachment flange, screw attached.
 - .1 Furring channel is not acceptable in place of resilient channel.
- .9 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .10 Steel drill screws: ASTM C1002.
- .11 Stud adhesive: ASTM C557.
- .12 Laminating compound: As recommended by manufacturer, asbestos-free.
- .13 Casing beads, corner beads, and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .14 Control joints: To ASTM C1047 and ASTM B69, zinc, 0.33 mm (0.013 inch) thickness, perforated flanges, 2.4 mm (3/32 inch) ground.
- .15 J-Trims: ASTM C1047, galvanized, minimum thickness 0.30 mm (0.012 inches).

- .16 Plenum barrier: Purpose made, bonded acoustical cotton, mineral wool fibre, or fibreglass, adhered to foil backing; 25 mm minimum thickness; to ASTM E84, Class A, flame spread ≤ 5 , smoke developed ≤ 35 .
- .17 Sealants: In accordance with Section 07 92 00 - Joint Sealants.
 - .1 Acoustic sealant: In accordance with Section 07 92 00 - Joint Sealants.
- .18 Polyethylene: CAN/CGSB 51.34, Type 2.
- .19 Joint tape: ASTM C475, 52 mm wide fibre paper tape.
- .20 Joint compound: ASTM C475, asbestos-free.

2.2 FINISHES

- .1 Texture finish: Asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for installation of gypsum board assemblies in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

- .1 Apply and finish gypsum board to ASTM C840 or GA-216 except where specified otherwise.
- .2 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles. Confirm locations with DCC Representative.
- .3 Install 19 x 64 mm furring channels parallel to, and at exact locations of, partition header track. Confirm locations with DCC Representative.
- .4 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .5 Furr above suspended ceilings for gypsum board fire and sound stops, and to form plenum areas as indicated.
- .6 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.
- .7 Install furring as required for fire resistance ratings indicated.

- .8 Furr openings and around built-in equipment, cabinets, and access panels on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .9 Furr duct shafts, beams, columns, pipes, and exposed services where indicated.
- .10 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with drywall screws.
- .11 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 work, and mechanical work have been approved.
- .2 Apply single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- .3 Double layer gypsum board:
 - .1 Base layer application:
 - .1 Apply gypsum board with long dimension parallel to studs.
 - .2 Position board with abutting edges located in centre of stud flanges.
 - .3 Stagger joints on opposite sides of partition so that joints occur on different studs.
 - .4 Screw-fasten base layer gypsum board to steel studs with 25 mm screws.
 - .2 Face layer application:
 - .1 Apply gypsum board with long dimension parallel to studs.
 - .2 Position board with abutting edges located in centre of stud flanges.
 - .3 Stagger joints from base layer joints, and on opposite sides of the partition.
 - .4 Screw-fasten face layer to steel studs with screws that are minimum 10 mm longer than the total thickness of the material being attached to the studs.
- .4 Install fire rated gypsum board in accordance with applicable ULC design number.
- .5 Apply water-resistant gypsum board where wall tiles to be applied, adjacent to sinks, janitors closets. 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 board using stud adhesive on furring or framing.

- .7 Apply board using laminating adhesive on base layer of gypsum board in double-layer applications.
- .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 - GENERAL

- .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 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 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .6 Provide continuous polyethylene dust barrier behind and across control joints.
- .7 Locate control joints where indicated on Drawings and at approximate 9 m spacing on long corridor runs.
 - .1 Place control joints consistent with lines of building spaces as indicated.
 - .2 Install control joints straight and true.
- .8 Splice corners and intersections together and secure to each member with 3 screws.
- .9 Install access doors to electrical and mechanical fixtures as specified in their respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .10 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.
- .11 Place corner beads at external corners.
 - .1 Use longest practical length.
 - .2 Place edge trim where gypsum board abuts dissimilar materials and as indicated.

- .12 Finish gypsum board walls and ceilings to following levels in accordance with GA-214:
 - .1 Concealed areas:
 - .1 Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
 - .2 Exposed areas scheduled for paint finish.
 - .1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .3 Exposed areas scheduled for paint finish:
 - .1 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.
- .13 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.
- .14 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .15 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .16 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .17 Treat cut edges and holes in moisture resistant gypsum board with sealant.
- .18 Mix joint compound slightly thinner than for joint taping.
- .19 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations, or tool marks.
- .20 Allow skim coat to dry completely.
- .21 Remove ridges by light sanding or wiping with damp cloth.

3.5 ACOUSTIC ACCESSORIES INSTALLATION

- .1 Install resilient channels at maximum 600 mm on centre. Locate joints over framing members.
- .2 Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- .3 Perform acoustic sealant application work to ASTM C919.

- .4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes and ducts, in partitions where perimeter is sealed with acoustic sealant.
- .5 Apply two 12 mm beads of acoustic sealant to bottoms of floor tracks and tops of ceiling tracks.

3.6 CEILING INSTALLATION

- .1 Install to ASTM C754 or GA-216.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.
- .3 Install ceiling framing independent of walls, columns, and above ceiling work.
- .4 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .5 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .6 Install work level, to tolerance of 1:1200.
- .7 Coordinate location of hangers with other work.
- .8 Reinforce openings in ceiling suspension system that interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 600 mm past each end of openings.
- .9 Laterally brace entire suspension system.
- .10 Locate control joints where indicated, at changes in substrate construction, and at approximate 15 m spacing on ceilings.

3.7 TOLERANCES

- .1 Maximum variation of finished gypsum board surface from true flatness: 3 mm in 3 m, in any direction.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.9 PROTECTION

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

- .2 Repair damage to adjacent materials caused by installation of gypsum board assemblies.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM C645-24, Standard Specification for Nonstructural Steel Framing Members
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 1.181-99, Ready-Mixed Zinc-Rich Coating

1.2 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 framing. Include product characteristics, performance criteria, physical size, finish, and limitations.

1.3 QUALITY ASSURANCE

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

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: To ASTM C645, stud size as shown on drawings, roll formed from hot dipped galvanized steel sheet, for screw attachment of gypsum board.
 - .1 Steel minimum thickness unless otherwise indicated on drawings:

- .1 0.84 mm (20 gauge).
- .2 Knock-out service holes at 460 mm centres.
- .3 Floor and ceiling tracks: In widths to suit stud sizes, 32 mm flange height.
- .2 Metal channel stiffener: 13 mm x width as required, 1.4 mm (16 gauge) thick cold rolled steel, coated with rust inhibitive coating.
- .3 Vented furring channels: 22 mm, 20 gauge.
- .4 Deflection track: To ASTM C645, 1.14 mm (0.043 inches) thick, with one slotted leg and one solid leg.
- .5 Touch-up primer for galvanized surfaces: CAN/CGSB 1.181.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

- .1 Align partition tracks at floor and ceiling and secure at maximum 600 mm on centre.
- .2 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
 - .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .3 Erect metal studding to tolerance of 1:1000.
- .4 Attach studs to ceiling track using screws, crimp method, or pop rivets.
- .5 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .6 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .7 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .8 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .9 Extend partitions to ceiling height except where noted otherwise on drawings.

- .10 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
 - .1 Use double track slip joint as indicated.
- .11 Install continuous insulating strips to isolate studs from uninsulated surfaces.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM C373-18, Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products
 - .2 ASTM E1155-20, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers
- .2 Terrazzo Tile and Marble Association of Canada (TTMAC):
 - .1 Tile Specification Guide 09 30 00, Tile Installation Manual 2019-2021
- .3 Tile Council of North America (TCNA):
 - .1 ANSI/TCNA A108/A118/A136.1:2024, American National Standard for the Installation of Ceramic Tile
 - .2 ANSI/TCNA A137.1:2022, American National Standard Specifications for Ceramic Tile

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data:
 - .1 Include manufacturer's information on:
 - .1 Tile, marked to show each type, size, and shape selected.
 - .2 Levelling compound.
 - .3 Bond coat.
 - .4 Grout.
 - .5 Finishing strips.
 - .6 Expansion/control joints.
- .3 Samples:
 - .1 Wall and floor tile: Submit duplicate, full-sized samples of each colour, texture, size, and pattern of tile proposed for installation.
 - .2 Finishing strips: Submit duplicate manufacturer samples, 100 mm long, showing profiles, materials, and finishes.

1.4 QUALITY ASSURANCE

- .1 Conform to TTMAC Tile Installation Manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.6 AMBIENT CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12°C for 48 hours before, during, and 48 hours after, installation.
- .2 Do not install tiles at temperatures less than 12°C or above 38°C.

1.7 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide minimum 2% of each type and colour of tile installed to project, for maintenance use. Store where directed.
 - .2 Maintenance material same production run as installed material.

Part 2 Products

2.1 WALL TILE

- .1 Ceramic Wall Tile:
 - .1 Dimensions: Nominal 100 x 305 mm (4 x 12 inches), 8 mm (5/16 inch) thick.
 - .2 Edges: Rectified.
 - .3 Finish: Satin.
 - .4 Pattern: 1/3 Running Bond.
 - .5 Moisture rating: 4 - non-vitreous.
 - .6 Colour: Satin white.

2.2 FLOOR TILE

- .1 Porcelain Floor Tile: To ANSI/TCNA A137.1.
 - .1 Dimensions: Nominal 300 x 600 mm (11.75 x 23.5 inches) x 10 mm thick.
 - .2 Edges: Rectified.
 - .3 Finish: Matte.
 - .4 Dynamic Coefficient of Friction: to ANSI/TCNA A137.1: Minimum 0.42 when wet.
 - .5 Water Absorption: < 0.1, MR-1 - impervious, in accordance with ASTM C373.
 - .6 Shade Variation: V2.
 - .7 Pattern: 1/2 Running Bond.
 - .8 Colour: as selected by DCC Representative from manufacturer's standard range.

2.3 SURFACE PREPARATION MATERIALS

- .1 Primer: Low VOC, low viscosity primer as recommended by manufacturer to suit substrate and site conditions; provide proof of bonding ability of setting system where manufacturer recommends that primer is not necessary to installation.
- .2 Leveling compound: Quick-setting, polymer-modified, fibre-reinforced cementitious leveling mortar.
- .3 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.
 - .1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.
 - .2 Capable of being walked on without damage after 3 hours.
 - .3 Capable of being coated after 24 hours at 21°C.

2.4 BOND COATS

- .1 Wall tile systems: to ANSI/TCNA A118.4 and A118.11, modified non-sagging dry-set cement mortar with polymer.
- .2 Floor tile systems: to ANSI/TCNA A118.7, high performance polymer modified Portland cement mortar.

2.5 GROUT

- .1 Wall tile: To ANSI/TCNA A118.7, premium polymer-modified Portland cement-based grout, unsanded, mould and mildew resistant.
- .2 Floor tile: To ANSI/TCNA A118.3, epoxy grout, 100% solids.
- .3 Colouring Pigments:
 - .1 Colouring pigments to be added to grout by manufacturer.
 - .2 Job coloured grouts are not acceptable.

2.6 ACCESSORIES

- .1 Finishing strips for walls: Type 304 brushed stainless steel profile with L-shaped visible surface, integrated perforated anchoring leg, and integrated grout joint spacer.
- .2 Baseboards: anodized aluminum, rounded top, flat exposed face, 8 mm (5/16 inch) radius lower section. Corners to match.
 - .1 Finish: matte white coated aluminum.
 - .2 Height: 80 mm (3 1/8 inch).
- .3 Prefabricated Movement Joints: Purpose made, with Shore A Hardness value minimum 60 and elasticity of plus or minus 40% when used in accordance with TTMAC Detail 301EJ. Anodized aluminum profiles with perforated anchoring legs, and replaceable integrated polymer inserts.
 - .1 Provide at spacing as recommended by TTMAC.
 - .2 Provide at perimeters of floors, around columns, where tile abuts other hard materials, at junctions between horizontal and vertical surfaces, and at transitions that include corridors and changes in direction.
 - .3 Confirm locations of movement joints with DCC Representative before installation.
- .4 Sealant: In accordance with Section 07 92 00 - Joint Sealants.
 - .1 Silicone, polyurethane, or elastomeric polyurethane.

2.7 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and levelling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for installation of tile in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

- .3 Confirm flatness of floor substrate by measurements taken in accordance with ASTM E1155.
 - .1 Standard Format Floor Tile: Tiles having dimensions from 100 x 100 mm and tiles with all sides less than 380 mm; require floor flatness measured to minimum FF35; equivalent to 5 mm with maximum 2 gaps under 3000 mm straightedge measurement.
- .4 Verify flatness of wall substrate. Apply leveling mortar to achieve flatness as required.
 - .1 Wall Tiles: Provide wall levelling similar to that specified for floors for tiles having similar sizes listed above.
 - .2 Maximum wall substrate variance from flatness: 3 mm in 3 metres.

3.2 INSTALLATION

- .1 Perform tile work in accordance with TTMAC Tile Installation Manual, except where specified otherwise.
- .2 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .3 Wall tile:
 - .1 Install in accordance with TTMAC 304W-2019-2021, Tile Installed over Gypsum Board.
- .4 Floor tile:
 - .1 Install in accordance with TTMAC 311F-2019-2021, Detail B, Tile Bonded to Concrete Slab (Epoxy).
- .5 Apply tile or backing coats to clean and sound surfaces.
- .6 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.
- .7 Maximum surface tolerance 1:800.
- .8 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.
- .9 Remove excess mortar from tile joint areas so at least 2/3 of the tile depth remains for grouting.
- .10 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .11 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .12 Allow minimum 24 hours after installation of tiles, before grouting.
- .13 Clean installed tile surfaces after installation and grouting cured.

- .14 Make control joints where indicated. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 00 - Joint Sealants. Keep building expansion joints free of mortar and grout.
- .15 Install accessories according to manufacturer's instructions.

3.3 CLEANING

- .1 Perform in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM D412-16(2021), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
 - .2 ASTM D2047-17, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
 - .3 ASTM D2240-15(2021), Standard Test Method for Rubber Property—Durometer Hardness
 - .4 ASTM D3389-21, Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)
 - .5 ASTM E648-23, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - .6 ASTM E662-21ae1, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - .7 ASTM E1155/E1155M-23, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers
 - .8 ASTM F925-13(2020), Standard Test Method for Resistance to Chemical of Resilient Flooring
 - .9 ASTM F970-22, Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading
 - .10 ASTM F1344-21a, Standard Specification for Rubber Floor Tile
 - .11 ASTM F1700-24, Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s)
 - .12 ASTM F1859-21a, Standard Specification for Rubber Sheet Floor Covering Without Backing
 - .13 ASTM F1861-21, Standard Specification for Resilient Wall Base
 - .14 ASTM F2169-15(2020), Standard Specification for Resilient Stair Treads
- .2 CSA Group:
 - .1 CSA B651-18, Accessible Design for the Built Environment
- .3 FloorScore:
 - .1 Indoor Air Quality (IAQ) Certification Standard, 2022
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .5 ULC Standards:
 - .1 CAN/ULC S102.2:2018, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data:
 - .1 Submit manufacturer's printed product literature and data sheets for resilient flooring and accessories; include product characteristics, performance criteria, sizes, finishes, and limitations.
 - .2 Submit two copies of WHMIS Safety Data Sheets (SDS).
- .3 Samples:
 - .1 Submit duplicate sample vinyl tiles, full size, showing pattern, colour, and finish.
 - .2 Submit duplicate 150 mm pieces of rubber base, showing profile, colour, and finish.
 - .3 Submit duplicate 50 mm wide sections of stair tread, demonstrating full profile and finish of tread and integral nosing.
 - .4 Submit duplicate 100 mm pieces of transition strip, showing profile, colour, and finish.
- .4 Shop Drawings: Indicate:
 - .1 Tile installation orientation.
 - .2 Seam layout.
 - .3 Cut-outs: Show locations where cut-outs are required.
 - .4 Edgings: Show location of edge mouldings.
 - .5 Stair resilient tread system: Show detail of interface between tactile warning strip and stair treads.
- .5 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- .6 Closeout Submittals:
 - .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 43 00 - Quality Assurance.
- .2 Install vinyl tile mock-up, minimum 8 x 8 tiles, in area designated by DCC Representative; illustrate selected materials, colour schemes, pattern, texture, direction of installation, finish fit to walls and doorways, seam finish, and quality of work.
- .3 Locate mock-up as directed by DCC Representative.
- .4 Allow for review of mock-up by DCC Representative before proceeding with resilient flooring installation.
- .5 Accepted mock-up may remain as part of finished work.

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 recommendations.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature and relative humidity within manufacturer's recommended ranges at flooring installation area, before, during, and after installation.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide additional 5% of actual installed area of each colour, pattern, and type of flooring material required for project, for maintenance use.
 - .2 Extra materials: from same production run as installed materials.
 - .3 Identify each box of vinyl tiles.
 - .4 Deliver to DCC Representative upon completion of work of this section and store where directed.

Part 2 Products

2.1 MATERIALS

- .1 Luxury vinyl plank (LVP): to ASTM F1700, Class 3, printed film vinyl tiles.
 - .1 Type B embossed.
 - .2 Backing: Light commercial grade.
 - .3 Floating and glue-down acceptable.
 - .4 Waterproof.
 - .5 Wear layer: minimum 0.5 mm (20 mil).
 - .6 Plank dimensions: 180 x 1525 mm (7 x 60 inch).
 - .7 FloorScore - IAQ certified.
 - .8 Chemical, heat and light resistance: to ASTM F925.
 - .9 Static load limit (ASTM F970): pass.
 - .10 Slip resistance (ASTM D2047): Minimum 0.6.
 - .11 Flame spread (ASTM E648): Class I.
 - .12 Smoke evolved (ASTM E662): 450 or less.
 - .13 Colour and pattern: as selected by DCC Representative from manufacturer's full range.
- .2 Sheet rubber flooring: To ASTM F1859, Type I; homogeneous vulcanized rubber compound with random scattered design.
 - .1 Thickness: 2 mm.
 - .2 Slip resistance (ASTM D2047): ≥ 0.5 .
 - .3 Static load (ASTM F970): pass.
 - .4 Abrasion resistance (ASTM D3389): pass.

- .5 Pattern and colour: As selected by DCC Representative from manufacturer's full range.
- .3 Resilient base: to ASTM F1861, continuous, top set, composition homogeneous throughout material.
 - .1 Type: TP - thermoplastic rubber.
 - .2 Thickness: nominal 3 mm (1/8 inch).
 - .3 Height: nominal 100 mm (4 inches).
 - .4 Lengths: cut lengths minimum 2400 mm.
 - .5 Profile:
 - .1 Cove (with toe): For resilient floor.
 - .6 Colour: as selected by DCC Representative from manufacturer's full range.
- .4 Transition Mouldings: PVC with additives and colourants, composition homogeneous through material.
 - .1 Hardness (ASTM D2240): Minimum 85 Shore A.
 - .2 Abrasion resistance (ASTM D3389): 0.22 mg/cycle.
 - .3 Slip resistance (ASTM D2047): pass.
 - .4 Height: as required for flooring materials to be transitioned.
 - .5 Changes in level: comply with accessibility requirements of CSA B651:
 - .1 0 to 6 mm vertical rise: vertical transition strip permitted.
 - .2 7 to 13 mm vertical rise: bevelled transition, not to exceed 1:2 ratio for rise:run.
 - .3 Over 13 mm vertical rise: bevelled transition, not to exceed 1:12 ratio for rise:run.
 - .6 Provide adhesive as recommended by transition strip manufacturer.
 - .7 Exposed horizontal width: 16 mm (5/8 inch).
 - .8 Colour: as selected by DCC Representative from manufacturer's full range.
- .5 Resilient stair tread: to ASTM F2169, synthetic rubber, square nosed, with integral riser.
 - .1 Length: As required to cover full width of stair.
 - .2 Tread pattern: Raised round disc.
 - .3 Tensile strength (ASTM D412): 8.2 MPa (1200 psi).
 - .4 Hardness (ASTM D2240): Minimum 85 Shore A.
 - .5 Abrasion resistance (ASTM D3389): < 1 g weight loss.
 - .6 Slip resistance (ASTM D2047): Minimum 0.8 SCOF.
 - .7 Fire resistance (ASTM E648): Class 1.
 - .8 Flammability (CAN/ULC S102.2):
 - .1 Flame spread: ≤ 300.
 - .2 Smoke developed: ≤ 500.

- .9 Colours: As selected by DCC Representative.
- .6 Tactile warning tiles: to ASTM F1344, Class 1-A and 1-B, and to CSA B651; with dome-style walking surface indicators.
 - .1 Tile size: 610 x 610 mm (24 x 24 inches).
 - .2 Base thickness: 3.2 mm.
 - .3 Dome height: 4.0 mm.
 - .4 Overall thickness: 7.2 mm.
 - .5 Slip resistance (ASTM D2047): ≥ 0.5 SCOF.
 - .6 Hardness (ASTM D2240): Minimum 85 Shore A.
 - .7 Static load limit (ASTM F970): pass.
 - .8 Abrasion resistance (ASTM D3389): < 1 g weight loss.
 - .9 Colour: as selected by DCC Representative from manufacturer's full range.
- .7 Primers and adhesives: Types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
- .8 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.
 - .1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.
 - .2 Capable of being walked on without damage after 3 hours.
 - .3 Capable of being coated after 24 hours at 21°C.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.
- .3 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.
 - .1 Composite flatness (F_F): Minimum 32.

- .2 Composite levelness (F_L): Minimum 20.
- .4 Ensure concrete substrate is free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers; curing, sealing, hardening, or parting compounds; alkaline salts, excessive carbonation or laitance, mould, mildew, and other foreign materials that might prevent adhesive bond.
- .5 Ensure that moisture and alkalinity, porosity, surface tolerance and surface profile of substrate are within manufacturer's recommendations.

3.3 PREPARATION

- .1 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .3 Prime concrete slab and plywood sub-floor to resilient flooring manufacturer's printed instructions.

3.4 PLYWOOD UNDERLAY

- .1 Install underlay plywood over wood subfloors as indicated.
- .2 Install plywood underlay smooth side up, with face grain oriented at right angle to underlying structure.
- .3 Stagger end joints and offset from joints in subfloor.
- .4 Space panels at 0.8 mm (1/32 inch) at edges and ends.
- .5 Fasten with ring- or screw-shank nails, spaced at 75 mm (3 inches) on panel edges and at 150 mm (6 inches) in panel field.
- .6 Fill edge gaps, splits, damaged areas, and rough spots with hard quick-setting filler acceptable to flooring manufacturer.
- .7 Sand joints to correct unevenness between panels that may telegraph through flooring.

3.5 APPLICATION: FLOORING

- .1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation as directed by DCC Representative.
- .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 lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.
- .4 As installation progresses, and after installation, roll flooring with 45 kg minimum roller to ensure full adhesion and prevent visible adhesive or trowel marks.
- .5 Cut flooring around fixed objects.

- .6 Cut and install resilient flooring to fit tightly in pan type floor access covers and to frames, with hardware cut-outs as required. Maintain floor pattern.
- .7 Heat weld all seams.
- .8 Continue flooring over areas that will be under built-in furniture.
- .9 Install resilient flooring continuous through doorways and scribed to fit projections and vertical surfaces.
 - .1 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
 - .2 Refer to Section 09 30 00 - Tiling for supply and installation of edging adjacent to ceramic tile.

3.6 APPLICATION: STAIRS

- .1 Scribe and tightly fit to stair profile and wall surfaces. Cut to align with base on landings. Securely bond stringer to substrate in a straight line.
- .2 Install stair treads and risers in one-piece full width of stairs. Apply adhesive evenly to back of coverings at rate sufficient to bond and to completely fill gaps, particularly at junctions. Set firmly in position tight to nosing and roll.
- .3 Install stair nosings in one piece for full width of stair. Fully adhere to tread edge using methods and adhesive in accordance with manufacturer's recommendations.
- .4 Install tactile warning strips at stair landings where shown, width of stair x 750 mm deep or as indicated, set back from front edge of stair one tread depth.
- .5 Install specified resilient stair landing material to intermediate stair landings.
- .6 Install stair treads and nosings flush with surfaces of floor covering.
- .7 Roll treads with hand roller after installation to ensure proper bonding.

3.7 APPLICATION: BASE

- .1 Clean substrate and prime as recommended by manufacturer.
- .2 Install resilient base in lengths as long as practicable, without gaps at seams, and with tops of adjacent pieces aligned.
- .3 Apply adhesive to back of base.
- .4 Do not stretch resilient base during installation.
- .5 Fit base at exterior and interior corners in accordance with manufacturer's recommendations and as follows:
 - .1 Internal corners: Butt and cope lip of base on one side.
 - .2 External corners, V-groove back of base, wrap around outside corners minimum 300 mm and bond to vertical surfaces with contact adhesive.
- .6 Set base against wall and floor surfaces tightly, using 3 kg hand roller.
- .7 Install base straight and level, with base in continuous contact with horizontal and vertical substrates.

- .8 Scribe and fit to door frames and other obstructions. Use pre-moulded end pieces at flush door frames.

3.8 CLEANING

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
- .2 Waste Management and Disposal: Remove waste material in accordance with Section 01 74 19 - Waste Management and Disposal.
- .3 Remove excess adhesive from floor, base, and wall surfaces without damage.
- .4 Clean floor and base surface to flooring manufacturer's printed instructions.

3.9 PROTECTION

- .1 Prohibit traffic on floor for 48 hours after installation.
- .2 Protect newly installed floors with non-marring covering from time of final set of adhesives until final inspection.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33
- .2 Environmental Protection Agency (EPA):
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 2020, (for Surface Coatings)
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .4 Master Painters Institute (MPI):
 - .1 MPI Architectural Painting Specifications Manual
 - .2 MPI Maintenance Repainting Manual
 - .3 MPI Approved Products List
- .5 National Fire Code of Canada 2020
- .6 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data and instructions for each paint and coating product to be used.
 - .2 Submit product data for the use and application of paint thinner.
 - .3 Submit two copies of WHMIS Safety Data Sheets (SDS).
 - .1 Indicate VOCs during application and curing.
- .3 Samples:
 - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
 - .2 Submit duplicate 200 x 200 mm sample panels of each paint, stain, clear coating, and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm birch plywood for clear finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

- .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
- .5 Siding for opaque finishes over wood surfaces.
- .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
- .4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions:
 - .1 Submit manufacturer's application instructions.
- .6 Closeout Submittals: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.

1.3 **MOCK-UPS**

- .1 Mock-ups: Apply mock-ups of each paint system indicated, in each colour and finish selected, to verify preliminary selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - .1 Construct mock-ups in accordance with Section 01 43 00 - Quality Assurance.
 - .2 DCC Representative will select surfaces to represent surfaces and conditions for application of each paint system specified.
 - .1 Vertical and Horizontal Surfaces: Provide samples of at least 9 m² (100 ft²).
 - .2 Other Items: DCC Representative will designate items or areas required.
 - .3 Apply mock-up samples after permanent lighting and other environmental services have been activated.
 - .4 Final approval of colour selections will be based on mock-ups.
 - .1 If preliminary colour selections are not approved, apply additional mock-ups of additional colours selected by DCC Representative at no added cost to contract.
 - .5 Approved mock-up may remain as part of finished work.

1.4 **MAINTENANCE**

- .1 Extra Materials:
 - .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

- .2 Quantity: provide one x 4 litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Delivery, storage and protection: comply with DCC Representative requirements for delivery and storage of extra materials.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Pack, ship, handle, and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
 - .1 Identify products and materials with labels indicating:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well-ventilated area within temperature range 7°C to 30°C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Fire Safety Requirements:
 - .1 Provide one 9 kg dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .9 Waste Management and Disposal:
 - .1 Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

- .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional, and Municipal regulations.
- .3 Ensure emptied containers are sealed and stored safely.
- .4 Dispose unused paint and coating materials at official hazardous material collections site.
- .5 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .6 Material that cannot be reused is to be treated as hazardous waste and disposed of in an appropriate manner.
- .7 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .8 To reduce the amounts of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .9 Set aside and protect surplus and uncontaminated finish materials. Turn over to DCC Representative for maintenance purposes.

1.6 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section 01 51 00 Temporary Utilities.
 - .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Coordinate use of existing ventilation system with DCC Representative and ensure its operation during and after application of paint as required.
 - .4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .5 Provide minimum lighting level of 323 Lux on surfaces to be painted.

- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless pre-approved with written approval by product manufacturer, perform no painting when:
 - .1 Ambient air and substrate temperatures are below 10°C.
 - .2 Substrate temperature is above 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is under 85% or when the dew point is more than 3°C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3°C below the ambient or surface temperature.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
 - .2 Allow new concrete and masonry to cure minimum of 28 days.
 - .3 Perform painting work when maximum moisture content of the substrate is below:
 - .1 15% for wood.
 - .2 12% for plaster and gypsum board.
 - .4 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
 - .5 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:
 - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of DCC Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

- .1 Provide paint materials for paint systems from single manufacturer.
- .2 Conform to latest MPI requirements for painting work, including preparation and priming.
- .3 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .4 Linseed oil, shellac, and turpentine: Highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

2.2 COLOURS

- .1 Colour schedule is to be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.
- .2 Selection of colours to be from manufacturer's full range of colours.
- .3 Where specific products are available in restricted range of colours, selection to be based on limited range.
- .4 Second coat in three-coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour-tinting operations prior to delivery of paint to site. Obtain written approval from DCC Representative for tinting of painting materials.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35

Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated.

2.5 EXTERIOR PAINTING SYSTEMS

- .1 Metal: Doors and frames:
- .1 EXT 5.3L – Polyurethane over epoxy primer.
 - .1 Coat 1: Epoxy primer, MPI #101.
 - .2 Coats 2 and 3: Polyurethane, MPI #72.
 - .2 Metal Fabrications
 - .1 EXT 5.3L – Polyurethane over epoxy primer.
 - .1 Coat 1: Epoxy primer, MPI #101.
 - .2 Coats 2 and 3: Polyurethane, MPI #72.
 - .3 Wood Stain: Non-toxic, zero VOC content.

2.6 INTERIOR PAINTING SYSTEMS

- .1 Metal: Doors and frames, ladders.
- .1 INT 5.3D – Epoxy over epoxy primer, G5 finish.
 - .1 Coat 1: Epoxy primer, MPI #101.
 - .2 Coats 2 and 3: Epoxy, MPI #177.
 - .2 Galvanized metal: Doors and door frames:
 - .1 INT 5.3M – High performance architectural latex, G5 finish.
 - .1 Coat 1: Water based primer, MPI #134.
 - .2 Coats 2 and 3: HIPAC latex, MPI #141.
 - .3 Gypsum wallboard, include access panels:
 - .1 INT 9.2B - High performance architectural latex.
 - .1 Walls: G4 finish.
 - .1 Coat 1: Latex primer/sealer, MPI #50.
 - .2 Coats 2 and 3: HIPAC latex, MPI #140.
 - .2 Ceilings: G3 finish.
 - .1 Coat 1: Latex primer/sealer, MPI #50.
 - .2 Coats 2 and 3: HIPAC latex, MPI #139.

- .2 Epoxy paint for gypsum wallboard where scheduled:
 - .1 INT 9.2N – Epoxy high build over latex sealer, G3-4 finish.
 - .1 Coat 1: Latex Primer/Sealer; MPI #50.
 - .2 Coats 2 and 3: MPI #108.
- .4 Dimension lumber: Stair stringers.
 - .1 INT 6.2D – Latex over latex primer, G3 finish.
 - .1 Coat 1: Latex primer: MPI #39.
 - .2 Coats 2 and 3: Latex, MPI #52.
- .5 Dressed lumber: Trim carpentry, doors and door frames.
 - .1 INT 6.3A – High performance architectural latex over latex primer, G5 finish.
 - .1 Coat 1: Latex primer, MPI #39.
 - .2 Coats 2 and 3: HIPAC latex, MPI #141.
- .6 Wood veneer faced doors:
 - .1 INT 6.3EE – Polyurethane varnish over waterborne stain – G4 (satin-like) finish.
 - .1 Coat 1: Semi-transparent stain, MPI #186.
 - .1 Colour: As selected by DCC Representative.
 - .2 Coats 2, 3, and 4: Polyurethane varnish, MPI #57.
- .7 Dressed lumber: Hardboard faced doors.
 - .1 INT 6.3A – High performance architectural latex over latex primer, G5 finish.
 - .1 Coat 1: Latex primer, MPI #39.
 - .2 Coats 2 and 3: HIPAC latex, MPI #141.
- .8 Electrical backboards.
 - .1 INT 6.4PP – Fire retardant coating, pigmented, waterborne, MPI #64.
 - .1 Apply in accordance with manufacturer's instructions. Apply to all six sides of plywood electrical backboards.
- .9 Scuff-resistant paint: Gypsum board assemblies, doors and door frames.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .1 Prior to commencing work, examine site conditions and existing substrates to be painted. Report to DCC Representative damages, defects, or unsatisfactory or unfavourable conditions or surfaces that will adversely affect this work.
- .2 Do not commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to Painting Subcontractor.
- .3 Maximum moisture content as follows:
 - .1 Gypsum board, stucco, and plaster: 12%.
 - .2 Wood: 15%.

3.4 PREPARATION

- .1 Protection:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings, and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by DCC Representative.
 - .2 Protect items that are permanently attached such as fire labels on doors and frames.
 - .3 Protect factory finished products and equipment.
 - .4 Protect passing pedestrians, building occupants, and general public in and about the building.
- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to be acceptable to DCC Representative.
- .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual and Maintenance Repainting Manual requirements. Refer to MPI Manual for specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming and wiping with dry, clean cloths.

- .2 Wash surfaces with a biodegradable detergent, bleach where applicable, and clean warm water, using stiff bristle brush to remove dirt, oil, and other surface contaminants.
- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes and vacuum cleaning.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- .6 Touch up of shop primers with primer as specified.
- .7 Do not apply paint until prepared surfaces are acceptable to DCC Representative.
- .8 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.5 APPLICATION

- .1 Method of application to be as approved by DCC Representative. Apply paint by brush and roller. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

- .4 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time as recommended by manufacturer.
- .6 Sand and dust between coats to remove visible defects.
- .7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .8 Repaint top, bottom, and vertical edges of doors to be repainted.
- .9 Finish closets and alcoves as specified for adjoining rooms.
- .10 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .2 Boiler room, mechanical and electrical rooms: Paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: Leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint both sides and edges of backboards for telecommunications 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.
- .11 Do not paint interior transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

- .1 Standard of Acceptance:
 - .1 Walls: No defects visible from 1000 mm at 90 degrees to surface.

- .2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .2 Advise DCC Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Cooperate with inspection and provide access to areas of work.
- .4 Retain purchase orders, invoices, and other documents to prove conformance with noted MPI requirements when requested by DCC Representative.

3.8 RESTORATION

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of DCC Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by DCC Representative.

3.9 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials 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 A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Manufacturer's data sheets and cutsheets.
 - .1 Provide typestyles, graphic elements, and layout for each sign.
- .3 Shop Drawings: Show fabrication and installation details for signs.
 - .1 Show sign mounting heights and accessories.
 - .2 Signage schedule: Itemize sign types, layouts, locations, sizes, and quantities.

1.3 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 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 specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EXTERIOR - CUT-OUT LETTERS

- .1 Numbers and letters: 150 mm (6") tall as indicated on drawings.
- .2 Material: Aluminum, 6mm (0.25"), clear finish.
- .3 Mounts: Threaded stud mounts with 38 mm (1.5") standoff.

- .4 Font: Helvetica

2.2 PARKING SIGNS

- .1 Parking signs: silkscreen-applied or vinyl film graphics, applied to 3.2 mm (1/8 inch) thick aluminum, pre-drilled mounting holes, radiused corners.
 - .1 Posts: U-channel type, galvanized steel to ASTM A123/A123M, with 9.5 mm punch holes on 25 mm centers.
 - .2 Attachment hardware: stainless steel nuts, bolts, and washers.

2.3 INTERIOR DOOR PLATES

- .1 Material: two-ply engravable plastic, 3.2 mm thick.
 - .1 Engrave 9.5 mm high, single line numerals incised to expose contrasting coloured core.
 - .2 Font: Helvetica.
 - .3 Colours: As selected by DCC Representative from manufacturer's full range.
- .2 Number plates for interior doors:
 - .1 Size: 25 x 150 mm. Allow for 3 digits per sign.
- .3 Attachment: Self-stick foam tape, 1.6 mm thick, polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides.
 - .1 Width: to suit sign sizes.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- .2 Verify that items are sized and located to accommodate signs.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Locate signs and accessories where indicated, using mounting methods complying with manufacturer's written instructions.
- .2 Install using self-stick foam tape.

- .3 Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
- .4 Mount tactile signage with horizontal centreline 1520 mm above finished floor.

3.3 **CLEANING**

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 After installation, clean soiled sign surfaces according to manufacturer's instructions. Protect signs from damage until acceptance by DCC Representative.
- .3 Remove temporary coverings and protection to adjacent work areas.
- .4 Repair scratches and other damage that may have occurred during installation. Replace components where repairs were made but are still visible to unaided eye from 3 metres.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment.
- .6 Waste Management: Remove waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.2 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 wall and corner guards; include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit two copies of WHMIS Safety Data Sheets (SDS).
- .3 Installation Drawings: Indicate on drawings large scale details, materials, finishes, dimensions, anchorage, and assembly.
- .4 Samples: Submit duplicate 300 mm long samples of profiles for corner guards.

1.3 QUALITY ASSURANCE

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

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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Corner Guards: Surface mount stainless steel corner guards, 50 mm leg, 3 mm (1/8 inch) radius, edge burrs removed.

- .1 Material: Minimum thickness 1.6 mm (0.063 inch, 16 gauge), stainless steel, type 304 or 316.
- .2 Finish: No. 4 satin finish, grain oriented parallel with length.
- .3 Height: From top of base to 1200 mm (48 inches) above finished floor.

2.2 ACCESSORIES

- .1 Adhesive: Water resistant type as recommended by manufacturer for substrate.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable for corner guard installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

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 INSTALLATION

- .1 Install units on solid backing and erect with materials and components straight, tight and in alignment.
- .2 Adhere corner guards to substrate at locations as indicated and according to manufacturer's guidelines.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.
- .4 Leave Work area clean at end of each day.
- .5 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .6 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Provide manufacturer's printed product literature and data sheets; include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.2 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Tools:
 - .1 Provide special tools required for assembly, disassembly, or removal of toilet and bath accessories, in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.
 - .2 Deliver special tools to DCC Representative.

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 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 and damaged materials with new.

1.5 WARRANTY

- .1 Provide Manufacturer's standard warranty for toilet and bath accessories; product to be free from manufacturer's defects for three years from date of substantial performance.

Part 2 Products

2.1 RESIDENTIAL WASHROOM ACCESSORIES

- .1 Coordinate bathroom accessories from one manufacturer series that match in general appearance.
- .2 Finish for residential washroom accessories: brushed nickel.
- .3 Towel Bars:
 - .1 Provide 610 mm long and 450 mm long towel bars in each bathroom.
- .4 Toilet Paper Holders:
 - .1 Provide one toilet paper holder in each bathroom.
- .5 Towel Rings:
 - .1 Provide one towel ring in each bathroom.
- .6 Robe hooks:
 - .1 Provide one robe hook in each bathroom.
- .7 Shower Rods:
 - .1 Adjustable length curved shower rod.
- .8 Bathroom mirrors, frame to match vanity and storage cabinet.
 - .1 Size: 610 x 914 mm.
- .9 Acceptable product lines:
 - .1 Delta.
 - .2 Moen.
 - .3 Taymor.

2.2 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 Concealed ferrous metal anchors and fastening devices: Galvanized.
- .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.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that conditions of substrates and surfaces to receive toilet and bathroom accessories 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.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
 - .1 Install solid wood backing at all attachment locations. Hollow wall anchors are not acceptable.
 - .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 bolts with lead expansion sleeves set into drilled holes.
 - .4 Toilet and shower compartments: Use male to female through bolts.
- .2 Install toilet and bath accessories level and plumb.
- .3 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 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

3.5 PROTECTION

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

- .2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canada Post:
 - .1 Delivery Planning Standards Manual – August 2023

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for mail boxes; include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings: Dimensions, panels, doors, trim, numbering, locking method, finishes, anchoring and attachments.

1.3 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 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Fabrication, configuration, and dimensions to Canada Post Delivery Planning Standards Manual.
- .2 Pedestal Mail Boxes: heavy gauge reinforced extruded aluminum. Sloped roof, weather protection hood. Trim and doors striated to resist scratching and marring.
 - .1 Frame:
 - .1 Extruded 6061 aluminum alloy surface.
 - .2 Interlocking and overlapping joints.

- .2 Shroud:
 - .1 Aluminum overhang 1-3/4" (44.45mm) to protect compartments from weather.
- .3 Pedestal:
 - .1 Painted steel or extruded 6061 aluminum alloy.
- .4 Compartments:
 - .1 Doors:
 - .1 Extruded 6063 aluminum alloy 3/16" (4.76mm) thick.
 - .2 Configuration:
 - .1 Lockboxes: Minimum size approximately 7.5-12.5 cm x 25 cm, each with 35 cm (min) of depth.
 - .2 Outgoing mail slot
 - .3 Master door.
 - .3 Locks:
 - .1 Heavy duty 5 pin cylinder cam locks, double cam locks for parcel locker. Each lock has three (3) keys.
 - .4 Identification:
 - .1 Engraved number plates.
- .5 Finish: Clear anodized aluminum.
- .6 Attachments: as recommended by manufacturer.

2.2 FABRICATION

- .1 Body: Make joints between components tight, with no gaps.
- .2 Doors: Form to prevent flexing when opening or closing. Weld corners and polish smooth.
- .3 Sand and polish welds smooth.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates to receive mailboxes are acceptable for product installation in accordance with manufacturer's instructions.
- .2 Inform DCC Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install mail boxes in accordance with manufacturer's written instructions.
- .2 Install plumb, level, and aligned.

3.3 ADJUSTING

- .1 Adjust doors and locks to operate correctly.
- .2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Aluminum Association (AA):
 - .1 AA DAF-45-2003, Designation System For Aluminum Finishes
- .2 ASTM International:
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .2 ASTM B209/B209M-21a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - .3 ASTM B221/B221M-21, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- .3 CSA Group:
 - .1 CSA-S157-17/S157.1-17, Strength design in aluminum/Commentary on CSA S157-17, Strength design in aluminum
- .4 Fenestration & Glazing Industry Alliance (prev. AAMA):
 - .1 AAMA CW-10-2015, Care & Handling of Architectural Aluminum from Shop to Site

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for sun control device components, anchorage and fasteners, internal drainage details; include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
 - .1 Refer to Section 01 35 73 - Delegated Design.
 - .2 Indicate system dimensions, framing requirements and tolerances, adjacent construction, anchor details, anticipated deflection under load, affected related Work, and field welding required.
 - .3 Include plans, elevations, sections, blade angles, blade spacing, and attachments to other compatible systems.
- .4 Delegated Design Submittals:
 - .1 Include framing member structural and physical characteristics, calculations, dimensional limitations, special installation requirements.

1.3 CLOSEOUT SUBMITTALS

- .1 Maintenance Data: submit maintenance data for sun control devices for incorporation into O&M manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with the manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Handle work of this Section in accordance with AAMA CW-10.
 - .2 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Store and protect product components from nicks, scratches, and blemishes.
 - .4 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
 - .5 Replace defective or damaged materials with new.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS – GENERAL

- .1 Design structural support framing components to CAN/CSA-S157 according to manufacturer's recommendations.
- .2 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC.
- .3 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable codes.
- .4 Ensure system allows for expansion and contraction within system components when temperature range is 85 degrees Celsius over 12-hour period without causing detrimental affect to system components.
- .5 Assembled sunshade to be capable of supporting combined load without damage, permanent deformation, or disengagement from glazed system mullion.
- .6 Blade deflection: maximum L/120 of span length.

- .7 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

2.2 SUN CONTROL DEVICES

- .1 Aluminum sunshade systems, including accessories, mountings, and shims; anchored directly to curtain wall or storefront mullions.
 - .1 Outriggers profile: as indicated on drawings.
 - .2 Blades: 51 x 152 mm (2 x 6 inches) high.
 - .3 Fascia: 51 x 203 mm (2 x 8 inches) tube.
 - .4 Mounting bracket: Aluminum, by manufacturer.
 - .5 Fasteners: Stainless steel, by manufacturer.

2.3 MATERIALS

- .1 Extruded aluminum: To ASTM B221, 6063 alloy, T5 or T6 temper.
 - .1 Aluminum finish: anodized black to match curtain wall and storefront framing.
- .2 Sheet aluminum: To ASTM B209.
- .3 Sealant: permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- .4 Isolation coating: Cold-applied asphalt-mastic paint, complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 0.76 mm thickness per coat.

2.4 FABRICATION

- .1 Fabricate components for assembly using manufacturer's standard installation instructions.
- .2 Sunshade Members: Manufacturer's standard extruded or formed-aluminum framing members of thickness and reinforced as required to support imposed loads.
- .3 Fasteners and Accessories: Nonmagnetic stainless steel, non-corrosive and compatible with aluminum members, anchors, and other components.
- .4 Perimeter Anchors: When steel anchors are used, provide isolation coating between steel material and aluminum material to prevent galvanic action.
- .5 Finishes:
 - .1 Finish coatings: conform to AA designations.

- .2 Exposed aluminum surfaces: to AA DAF-45 Architectural Class I, 18 µm thickness, anodized to black finish.
- .3 Concealed steel items: galvanized in accordance with ASTM A123, 380 g/m².
- .4 Apply 1 coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Verify dimensions, tolerances, and method of attachment with other work.
 - .3 Inform the DCC Representative of unacceptable conditions.
 - .4 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install sun control devices in accordance with manufacturer's instructions.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Use alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
- .6 Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- .7 Fit joints to produce hairline joints free of burrs and distortion.
- .8 Rigidly secure non-movement joints.
- .9 Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

- .10 Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- .11 Seal joints watertight as shown on reviewed shop drawings and manufacturer's standard installation instructions.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Remove protective material from prefinished aluminum surfaces.
 - .3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
 - .4 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
 - .5 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Not Used

1.2 INTENT

- .1 The Specification shall be read as a whole by all parties. Sectioning of the Specification is for convenience only; each section may contain less or more than the completed Work of any trade. The Contractor is solely responsible to understand the scope of Work and make clear to Subcontractors the extent of their Work in this section.
- .2 Sections of these Specifications are not intended to delegate functions or to delegate Work and supply to any specific trade. The Work shall include all labour, materials, equipment and tools required for a complete and working installation as described in the Drawings and these Specifications.
- .3 Specifications are an integral part of accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, is to be considered as properly and sufficiently specified.
- .4 Be completely responsible for acceptable condition and operation of systems, equipment, and components forming part of installation or directly associated with it. Promptly replace defective material, equipment, and parts of equipment and repair related damages.

1.3 SECTIONS AFFECTED

- .1 These instructions apply to and form a part of all Mechanical Sections.

1.4 REGULATIONS

- .1 Perform Work in accordance with codes, rules, regulations, by-laws, and requirements of authorities having jurisdiction. Refer to 014100 - Regulatory Requirements.
- .2 These specifications are supplementary to requirements above.
- .3 Drawings and specifications should not conflict with above regulations, but where there are apparent discrepancies, notify DCC Representative.

1.5 PERMITS, FEES INSPECTION

- .1 Obtain permits, make submissions, pay fees, and arrange for inspections required for Mechanical work.

1.6 DRAWINGS, CHANGES AND INSTALLATION

- .1 Drawings show the general intent and scope of the Work and not exact details of installation. Installation is to be complete with accessories required for complete and operational system.
- .2 Location, arrangement, and connection of equipment and material as shown on the drawings represents a close approximation to intent and requirements of the work. The right is reserved by DCC Representative to make reasonable changes required to accommodate conditions arising during progress of the Work, at no extra cost to the Contract.
- .3 In order to more clearly show arrangement of the Work, plans and sections do not show every valve, thermometer, pressure gauge, or other system accessory. Refer to Mechanical Standard Details and to Specifications to determine requirements.
- .4 Equipment installed by Mechanical Divisions is to be installed in accordance with manufacturer's installation requirements. In event of conflicts between Drawings or Specifications and manufacturer's installation requirements, notify DCC Representative.
- .5 Certain Details indicated on the Drawings are general in nature and specific labelled detail references to each occurrence of use are not indicated, however, such details are applicable to every occurrence.
- .6 Conceal piping and ductwork in finished areas in ceiling spaces and shafts or chased into walls. No exposed piping or ductwork is to be installed in such areas unless specifically reviewed and accepted by DCC Representative. No piping is to be concealed in outside walls.
- .7 Vent pipes, exhaust hoods or other mechanical equipment mounted on roof, or housing for such equipment, is not to be closer to edge of roof than distance equal to height of pipe, hood, or equipment, unless specifically reviewed and accepted by DCC Representative.
- .8 Locations and sizes of existing services shown on the Drawings are based on best available information. Verify actual location of existing services in field before work is commenced. Pay particular attention to buried services.
- .9 Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other Trades, or to accommodate existing conditions, shall be made at no extra cost to the Contract.
- .10 Leave areas clear of piping and ducts where space is indicated as reserved for future equipment and equipment for other Trades.

- .11 Make adequate space and provisions for removal of coils and servicing of equipment, with minimum inconvenience to operation of systems.
- .12 Where equipment is shown to be 'roughed-in only' obtain accurate information from DCC Representative before proceeding with Work.
- .13 Before fabricating ductwork or piping for installation, make certain that such items can be installed as shown on the Drawings without interfering with structure or work of other Trades. Problems that cannot be solved in agreement with other Trades affected are to be submitted for decision. If ductwork or piping is pre-fabricated prior to investigation and determination of solution to possible interference problems, make necessary changes in such pre-fabricated items at no extra cost to the Contract.
- .14 Location of diffusers, grilles registers, thermostats, sprinklers, and other equipment shown on plans is diagrammatic. Layout of each device in finished areas is critical in terms of symmetry and location. Refer to Architectural Drawings and to site instructions in all regards. Work not installed in correct location (at sole discretion of DCC Representative) is to be remedied by Contractor at their own expense. Contractor is responsible for mark-out of their work, fully co-ordinated with other trades, in sufficient time for review by DCC Representative prior to rough-in. Locate mechanical and sprinkler services precisely.
- .15 Prepare dimensioned layouts of each room prior to rough-in for review by DCC Representative. Do not proceed with work until DCC Representative has reviewed layout.

1.7 INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

- .1 Installation, interference and setting Drawings dimensioned and to scale, are to be submitted for review by DCC Representative, as may be required or requested by DCC Representative to make clear work intended or to show its relation to adjacent work or to work of other trades. When alternative piece of equipment is to be substituted for equipment shown, Drawings of area involved are to be prepared by Mechanical Divisions. Submit three copies of such Drawings for review, of which one will be retained by DCC Representative.
- .2 Installation working Drawings to 1:50 scale for mechanical rooms showing plan and sections of plant, services, bases, curbs, drains, motor terminals, are to be prepared by Mechanical Divisions.
- .3 Interference Drawings are required for shafts, ceiling spaces, typical floors and wherever there is possible conflict with positioning of mechanical equipment, piping, or ductwork and architectural or structural features or work of other trades.

- .4 Design of structural framing of mechanical rooms and pipe spaces and major pipe run supports has been based on assumed loadings supplied during design phase. Well ahead of construction of affected areas, prepare and submit Drawings for review by DCC Representative showing layout and weights of finally selected mechanical equipment including details of concrete pads, concentrated pipe loads and point reactions of equipment onto structure.
- .5 Prepare sleeving Drawings indicating size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for piping, ductwork, and equipment. In case of failure to provide information in time (i.e. before the concrete is poured), extras incurred will be at expense of Mechanical Divisions.
- .6 Work shall not proceed in areas involved until after final review of such Drawings has been obtained.

1.8 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for equipment.
- .3 Shop drawings:
 - .1 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, including ASHRAE 90.1 and the Model National Energy Code of Canada for Buildings.
 - .3 In addition to transmittal letter referred to in Section 01 33 00, use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.9 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for all equipment.

- .1 Operation and maintenance manual approved by, and final copies deposited with, 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:
 - .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.
- .5 Approvals:
 - .1 Submit 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 Provide sets of 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 reproducible, revising reproducible 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.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One 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.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect all equipment from nicks, scratches, and blemishes
 - .3 Replace defective or damaged materials with new.

1.12 INTEGRATED SYSTEMS TESTING OF FIRE PROTECTION AND LIFE SAFETY SYSTEMS

- .1 All new system and systems for renovated areas shall be tested and verified in accordance with Standard CAN/ULC-S1001 Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.
- .2 Contractor is to carry all costs associated with engaging a third party to act as the Integrated Testing Coordinator to perform all required tasks as listed in CAN/ULC S1001. The Integrated Testing Coordinator is to lead all testing and commissioning procedures and provide all documents required to fulfill the full extent as described in the standard.
- .3 Integrated Testing Coordinator must be a registered Professional Architect or Engineer in good standing and have all necessary certifications as dictated by S1001 and the local AHJ.
- .4 All final documentation as listed in the standard are to be forwarded to the consultant, sealed by the Integrated Testing Coordinator indicating that all systems have been installed, tested and commissioned to meet all applicable codes and standards.
- .5 Testing must be completed prior to applying for occupancy permit (including interim permits).

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 CO-OPERATION WITH OTHER DIVISIONS

- .1 Pay particular attention to proximity of electrical conduit and cable to mechanical piping and equipment.
- .2 Install pipes transporting hot fluids at least 150 mm (6 inches) away from pipes carrying cold fluids, unless approval from DCC Representative is obtained to install services closer than 150 mm (6 inches).
- .3 Electrical conduits shall not touch or be supported from piping or ductwork.
- .4 Each Section is to confine itself to installing materials in spaces shown, without encroaching upon space for materials installed under other Sections or Divisions. Where space allocated to another Section or Division is encroached upon, relocate materials to their proper space allocation in manner to complete work using space allocated to various Sections and Divisions. Relocation of materials

and work involved shall be paid for by the Section responsible for the encroachment at no extra cost to the Contract.

- .5 Supply items to be built in ample time for rapid progress of the work. Schedule and proceed with work as required to satisfy construction schedule.
- .6 Confirm available voltage for single phase and three phase motors or other similar electrically driven equipment with Electrical Division prior to ordering equipment. Discrepancy between requirements identified within Contract Documents and those of Electrical Division are to be reported to DCC Representative and the equipment adjusted to suit appropriate power requirements. Failure to perform this coordination prior to ordering of motors or equipment shall result in correction at no additional cost to the Contract.

3.2 TEMPORARY USE OF EQUIPMENT

- .1 Where mechanical systems are operated during construction, maintain systems and equipment in proper operating condition.
- .2 Prior to application for substantial performance of the Work as certified by DCC Representative, return systems and equipment to initial new condition by replacing used air filters with new air filters, cleaning air side of coils in air handling systems, replacing used belts in belt drives with new belts, lubricating bearings according to manufacturer's factory standards and adjusting thermostatic control system according to specifications and to suit DCC Representative.

3.3 FIRE STOPPING

- .1 All new and abandoned penetrations of rated assemblies shall be fire stopped to ensure the continuity and integrity of the fire separation. Refer to section 07 84 00.
- .2 For existing floor assemblies where the assembly rating is unknown, provide fire stopping with 1 hour rating.

3.4 DEMONSTRATION

- .1 DCC Representative will use equipment and systems for test purposes prior to acceptance. Supply personnel, material, and instruments required for testing.
- .2 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting, and servicing of systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 DCC Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.6 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 National Fire Prevention Association (NFPA)
 - .1 NFPA 13R-2019, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies
 - .2 NFPA (Fire) 20-2022, Standard for the Installation of Stationary Pumps for Fire Protection, 2022 Edition.
 - .3 NFPA (Fired) 24-2022, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2022 Edition.
 - .4 NFPA 25-2017, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 ULC Standards
 - .1 CAN/ULC S543, 2022, Standard for Safety Internal Lug Quick-Connect Couplings for Fire Hose.

1.2 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 applicable Territory or Province of Canada and in accordance with Section 01 35 73.
 - .2 Include:
 - .1 Hazard Analysis,
 - .2 Working Plans,
 - .3 Assembly Details,
 - .4 Water Supply Test Information in accordance with NFPA 291,
 - .5 Hydraulic Calculations,
 - .6 Hydraulic Calculation Forms
 - .3 Indicate: Materials, finishes, method of anchorage, number of anchors, supports, reinforcement, assembly details, and accessories.
- .4 Test reports: Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance

with specifications for specified performance characteristics and physical properties.

- .5 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturers' Instructions: Provide manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide operation, maintenance, and engineering data for incorporation into O&M manual specified in Section 01 78 00 - Closeout Submittals in accordance with NFPA 20.
- .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 Water motor alarms.
 - .5 Sprinkler heads.
 - .6 Pipe hangers and supports.
 - .7 Pressure or flow switch.
 - .8 Fire department connections.
 - .9 Excess pressure pump.
 - .10 Mechanical couplings.
- .3 Drawings:
 - .1 Sprinkler heads and piping system layout:
 - .1 Prepare detailed working drawings of system layout in accordance with NFPA 13R, "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.
- .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.
- .7 Operation and Maintenance Manuals:
 - .1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in wet sprinkler systems with documented experience.
- .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from 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: Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.
 - .1 Provide spare sprinklers and tools in accordance with NFPA 13R.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Storage and Protection:
 - .1 Store materials indoors.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

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 13R, by hydraulic calculations for uniform distribution of water over design area.

- .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 consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.
- .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 13R for hazard occupancy indicated on the drawings.
 - .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 area as defined in NFPA 13R.
- .10 Outside Hose Allowances: Include allowance in hydraulic calculations in accordance with NFPA.
- .11 Friction Losses: Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.
- .12 Water Supply: Obtain water flow data of street mains prior to starting hydraulic calculations. Water supply test data to be obtained in accordance with NFPA 291.

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 13R.
 - .2 Copper tube: to NFPA 13R.
- .2 Fittings and joints to NFPA 13R:
 - .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 Copper tube: screwed, soldered, brazed, grooved.
 - .3 Provide welded, threaded, or grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .4 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.
 - .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
 - .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .8 Side outlet tees using rubber straps are not permitted.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Gate valves: open by counter-clockwise rotation.
 - .3 Provide rising stem valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
 - .4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 100 mm and larger.
- .4 Pipe hangers: ULC listed for fire protection services in accordance with NFPA.

2.4 SPRINKLER HEADS

- .1 General: to NFPA 13R and ULC listed for fire services.
- .2 Sprinkler Head Type:

- .1 Refer to type and location of sprinkler heads on drawings
- .3 Provide nominal 12 mm (1/2 inch) orifice sprinkler heads.
 - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
 - .2 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
 - .3 Deflector: not more than 75 mm (3 inch) below suspended ceilings.
 - .4 Ceiling plates: not more than 25 mm (1 inch) deep.
 - .5 Ceiling cups: not permitted.

2.5 SUPERVISORY SWITCHES

- .1 General: To NFPA 13R, and ULC listed for fire service.
- .2 Valves: Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Pressure or flow switch type:
 - .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: Section 28 31 00 - Fire Detection and Alarm.
 - .5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.
- .4 Pressure alarm switch: With normally open and normally closed contacts and supervisory capability.

2.6 FIRE DEPARTMENT CONNECTION

- .1 Provide connections approximately 1.5 metres above finish grade, location as indicated.
- .2 To NFPA 13R and ULC S543 listed, Siamesetype.
- .3 Thread specifications: compatible with local fire department.
- .4 Install a 90-degree elbow with drain connection at the low-point near each fire department connection to allow for system drainage to prevent freezing.

2.7 PRESSURE GAUGES

- .1 ULC listed and to Section 23 05 19 - Thermometers and Pressure Gauges - Piping Systems.

- .2 Maximum limit of not less than twice normal working pressure at point where installed.

2.8 BURIED WATER PIPING SYSTEM

- .1 Pipe and Fittings:
 - .1 Provide welded stainless steel or PVC, and fittings, in accordance with NFPA 24, for piping under building and outside of building walls.
 - .2 Anchor joints in accordance with NFPA 24.
 - .3 Provide concrete thrust block at elbow where pipe turns up toward the floor, and restrain pipe riser with stainless steel rods from elbow to flange above floor.
 - .4 Minimum depth of cover: 2.0 metre at finish grade.
- .2 Fittings for Ductile Cast Iron Pipes:
 - .1 Mechanical joint, and flange.
 - .2 Fittings: painted with epoxy resin paint.
- .3 Bolt and Nut for Flange:
 - .1 Galvanized Hexagon Head bolts and Hexagon nuts.
- .4 Valves:
 - .1 In accordance with NFPA 24.
 - .2 Gate valves: ULC listed and opened by counterclockwise rotation.

2.9 PIPE SLEEVES

- .1 Provide pipe sleeves where piping passes through walls and floors.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of floors and walls.
- .4 Provide 25 mm (1 inch) 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, or provide mechanically adjustable segmented elastomeric seal.
 - .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.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide cast-iron sleeves, ductile-iron, or hot-dip galvanized steel.

- .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 split hinge or one piece type metal plates for piping passing through walls, ceilings floors, in exposed spaces.
- .2 Provide satin finish stainless steel, satin finish chrome or nickel plated brass with non-ferrous set screws in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

2.11 INSPECTOR'S TEST CONNECTION

- .1 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .2 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.12 SIGNS

- .1 Attach properly lettered and approved metal signs to each valve and alarm device to NFPA 13R.
- .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 13R.

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 13R and NFPA 25.

3.3 WATER SUPPLY

- .1 Obtain water flow data of street mains prior to starting hydraulic calculations. Water supply test data to be obtained in accordance with NFPA 291.

3.4 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.

3.5 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 - Fire Detection and Alarm.
- .3 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.
- .4 Provide wiring in rigid metal conduit or intermediate metal conduit.

3.6 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 Hydrostatically test each system at 200 psig for 2 hour period with no leakage or reduction in pressure.
 - .2 Flush piping with potable water in accordance with NFPA 13.
 - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
 - .4 Test alarms and other devices.
 - .5 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.

- .6 Test backflow preventers through a dedicated test header at maximum system design flow. This flow shall discharge to the exterior in a location and manner so as to not cause flooding or damage to landscape. A copy of the initial flow test results shall be permanently posted at the backflow prevention device.
- .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and accepted.
 - .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 Site Tests:
 - .1 Testing to be witnessed by authority having jurisdiction.
 - .2 Develop, with DCC Representative assistance, detailed instructions for O & M of this installation.

3.7 IDENTIFICATION

- .1 Provide a valve chart and matching floor plan for all water fire protection systems in the sprinkler room. The valve chart shall be framed and include drain valves, valve number, physical location and valve position. The valve identification signs installed on each valve shall match the valve chart identification scheme.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 National Fire Prevention Association (NFPA)
 - .1 NFPA 10-2013, Standard for Portable Fire Extinguishers.
- .2 ULC Standards
 - .1 CAN/ULC-S508-02, Standard for the Rating and Fire Testing of Fire Extinguishers.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings
 - .1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .4 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .5 Storage and Protection:
 - .1 Store materials indoors.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

- .1 Portable fire extinguishers to CAN/ULC-S508.
- .2 Stored pressure type, large loop pull pin, shut-off nozzle, ULC labelled.
 - .1 Valve assemblies: All metal, On/Off squeeze grip handles.
 - .2 Finish: High gloss polyester powder paint or baked enamel.
 - .3 Colour: Red.
- .3 Types:
 - .1 F.E.-1: General Areas

- .1 Minimum 3A40BC rating, 2.26 kg (5 lbs.) multi-purpose dry chemical powder type (ammonium phosphate). Mounted in finished cabinet.

2.2 CABINETS

- .1 Cabinets, finished areas: semi-recessed:
 - .1 Frame: 6mm (1/4 in.) return.
 - .2 Tub: steel, 0.76 mm (0.0299 in. – 22 M.S.G.) thick, enamel interior.
 - .3 Maximum inside dimensions of 229 mm x 610 mm x 152 mm (9 in. x 24 in. x 6 in.) deep.
 - .4 Door: steel, adjustable, 1.57 mm (0.0618 in. – 16 M.S.G.) thick.
 - .5 Glass: 5mm (3/16 in.), clear.
 - .6 Hinge: full length semi-concealed piano type.
 - .7 Door latch: flush stainless-steel, no visible mounting screws.
 - .8 Exterior metal: prime coated except door latch.
- .2 Ensure recessed cabinets in rated partitions have a fire resistance rating that will maintain integrity of fire separations.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Comply with manufacturer's written recommendations, specifications, product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with NFPA 10.
- .2 Installed height of fire extinguishers shall be in accordance with CSA B651:23. Coordinate exact mounting height with other trades to have consistent height. Refer to Architectural detail for typical mounting heights.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00- Cleaning.
Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A126-04(2019), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 AWWA C702-19, Cold Water Meters-Compound Type.
- .3 CSA Group
 - .1 CAN/CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08(R2018), Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP)
 - .1 IPMVP 2007 Version.
- .5 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2020 (NPC).
- .6 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101-2017, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201-2017, Water Hammer Arresters Standard.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Shop drawings:
 - .1 Submit plans showing locations and sizes of all water hammer arrestors.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Submit operation and maintenance data for plumbing specialties and accessories for incorporation into O&M manual.
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year, and capacity.
 - .2 Details of operation, servicing, and maintenance.
 - .3 Recommended spare parts list.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, with manufacturer's original labelling.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. Protect plumbing materials from nicks, scratches, and blemishes.

Part 2 Products

2.1 FLOOR DRAINS

- .1 Floor Drains and Trench Drains: To CSA B79.
- .2 All floor drains to have a trap primer connection unless otherwise noted.
- .3 FD-1: Finished areas; cast iron body, round, adjustable head, 127 mm diameter, 6.35 mm thick nickel-bronze strainer, integral seepage pan, clamping collar.
- .4 FFD-1: Combination funnel floor drain; cast iron body with integral seepage pan, clamping collar, minimum nominal 127 mm diameter, 6.35 mm thick nickel-bronze strainer, full opening for funnel and nominal 75 mm x 225 mm oval funnel.

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.
 - .1 Access Covers:
 - .1 Wall Access: Face or wall type, round polished nickel bronze square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

- .2 Floor Access: Round cast iron body and frame with adjustable secured nickel bronze top and:
 - .1 Plugs: Bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: Nickel-bronze frame round cast iron, gasket, vandal-proof screws.
 - .3 Cover for Terrazzo Finish: Polished nickel-bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
 - .4 Cover for Tile and Linoleum Floors: Polished nickel-bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
 - .5 Cover for Carpeted Floors: Polished nickel-bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

- .1 Stainless steel, bellows or piston type: To PDI-WH201.

2.4 BACK FLOW PREVENTERS

- .1 Preventers: To CAN/CSA-B64 Series, application double check valve assembly or reduced pressure principle type as required.

2.5 PRESSURE REGULATORS

- .1 Capacity and pressures: As indicated.
- .2 Up to NPS 1-1/2 bronze bodies, screwed: To ASTM B62.
- .3 NPS 2 and over, semi-steel bodies, Class 125, flanged: To ASTM A126, Class B.
- .4 Semi-steel spring chambers with bronze trim.

2.6 BUILDING WATER METER

- .1 Capacity & Type: to approval of local Authority having Jurisdiction.
- .2 Accessories: Remote readout device for connection to BMS.

2.7 TRAP SEAL PRIMERS

- .1 All bronze body with integral vacuum breaker, non-liming internal operating piston, stainless steel spring, removable bronze seat with metering orifice, and sealed bronze cover.

2.8 THERMOSTATIC MIXING VALVE

- .1 Thermostatic mixing valves: Combination thermostatic and pressure balanced water controller, 38 mm (1-1/2 inch) inlet and 50 mm (2 inch) outlet, liquid filled motor.
 - .1 Valve to maintain output temperature for changes in inlet pressure and temperature.
 - .2 Valve construction: Bronze body and stainless steel piston and liner.
 - .3 Mixing valve to include union end stop and check valve with removable strainer on each inlet. Complete with 0 – 200°F. dial thermometer and shut off valve on tempered water outlet.

2.9 DOMESTIC HOT WATER EXPANSION TANK

- .1 Pre-charged steel thermal expansion tank with a fixed butyl bladder. The tank shall have a bladder integrity monitor and a .302" - 32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet system requirements. The tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code.

2.10 NON-FREEZE WALL HYDRANTS

- .1 Recessed type with integral vacuum breaker, NPS ¾ hose outlet, removable operating key. Chrome plated finish.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada (NPC) and local authority having jurisdiction
- .2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.4 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to groups of fixtures and all fast-closing fixtures (washing machines, dishwashers, etc.).
- .2 Size water hammer arrestors to accommodate fixture load of fixtures served.
- .3 Arrestors must be accessible for replacement/service.

3.5 BACK FLOW PREVENTERS

- .1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code. Install back-flow preventers for connections to potable water systems in which backflow may occur, including:
 - .1 Drains
 - .2 Connections to equipment
 - .3 Water make-up assemblies.
- .2 Pipe discharge to terminate over nearest drain or service sink.

3.6 TRAP SEAL PRIMERS

- .1 Connect to all floor drains with trap primer connections with 13mm domestic water piping.

3.7 WATER METERS

- .1 Install water metre provided by local water authority.
- .2 Install water metre as indicated.

3.8 NON-FREEZE WALL HYDRANTS

- .1 Install 600 mm (24 inches) above finished grade in locations indicated.

3.9 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.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.

3.10 TESTING AND ADJUSTING

- .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 – General Commissioning Requirements, supplemented as specified.

- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
- .4 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.
- .5 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.
- .6 Vacuum breakers, backflow preventers, backwater valves:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
 - .3 Verify visibility of discharge from open ports.
- .7 Access doors:
 - .1 Verify size and location relative to items to be accessed.
- .8 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .9 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.
- .10 Water meters:
 - .1 Verify location and accessibility.
 - .2 Test meter reading accuracy.

3.11 CLOSEOUT ACTIVITIES

- .1 Training: Provide training in accordance with Section 01 79 00.13 – Demonstration and Training for Building Commissioning, supplemented as specified.

3.12 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A213/A213M-22a, Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes.
 - .2 ASTM B32-08, Standard Specification for Solder Metal.
 - .3 ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing
 - .4 ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
 - .5 ASTM F2080 – Standard Specification for Cold-Expansion Fittings with Metal Compression Sleeves for Crosslinked Polyethylene (PEX) Pipe
- .2 American National Standards Institute/American Water Works Association (AWWA)
 - .1 AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .2 ANSI/AWWA C151/A21.51-09, Ductile Iron Pipe, Centrifugally Cast.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
 - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS).
- .4 Manufacturers Standardization Society (MSS)
 - .1 MSS SP-67-2022, Butterfly Valves
 - .2 MSS SP-70-2011, Gray Iron Gate Valves, Flanged and Threaded Ends
 - .3 MSS SP-71-2018, Gray Iron Swing Check Valves, Flanged and Threaded Ends
 - .4 MSS SP-80-2019, Bronze Gate, Globe, Angle and Check Valves
- .5 National Research Council (NRC)
 - .1 National Plumbing Code of Canada (NPC) 2020.
- .6 National Sanitation Foundation (NSF)
 - .1 NSF/ANSI/CAN 61-2022, Drinking Water System Components – Health Effects, Includes Errata (2022).
 - .2 NSF/ANSI/CAN 372-2022, Drinking Water System Components – Lead Content.
 - .3 NSF/ANSI/CAN 14 – Plastic Piping System Components and Related Materials

- .7 Canadian Standards Association
 - .1 CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .1 Grooved joint couplings and fittings shall be referred to on drawings and product submittals by the manufacturer's listed model or series designation.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into O&M manual specified in Section 01 78 00 – Closeout Submittals.

Part 2 Products

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground:
 - .1 Copper tube, hard drawn, type L: to ASTM B88M.
 - .2 Crosslinked polyethylene (PEXa): to ASTM F876, ASTM F877 CSA B137.5, NSF/ANSI 14 and NSF/ANSI 61.
 - .2 Buried or embedded:
 - .1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
 - .2 Crosslinked polyethylene (PEXa): to ASTM F876, ASTM F877 CSA B137.5, NSF/ANSI 14 and NSF/ANSI 61.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze 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.
- .5 Cold-expansion compression-sleeve design fitting for PEX: to ASTM F877, ASTM F2080, NSF/ANSI 14, NSF/ANSI 61 and CSA B137.5 and approved by the manufacturer's PEX piping system

2.3 JOINTS

- .1 Solder: Tin copper alloy 95/5, 96-6 tin silver, or 96-4 tin silver solder, ASTM B32.
- .2 Teflon tape: For threaded joints.
- .3 Grooved joint couplings: two ductile iron housing segments cast with offsetting angle-pattern bolt pads, pressure responsive Fluoroelastomer Center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, and ASTM A449 compliant bolts and nuts. Installation-Ready, for direct stab installation without field disassembly.
 - .1 UL classified in accordance with NSF-61 for potable water service, and meets the low-lead requirements of NSF-372.
- .4 Dielectric connections between dissimilar metals:
 - .1 dielectric waterway, copper-silicon casting conforming to UNS C87850, with threaded and/or grooved ends. UL classified in accordance with ANSI / NSF-61 for potable water service.

2.4 GATE VALVES

- .1 NPS 2-1/2 and over, flanged:
 - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

2.5 GLOBE VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.
 - .2 Lockshield handles: as indicated.
- .2 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, renewable composition disc as specified Section 23 05 23.01- Valves - Bronze.
 - .2 Lockshield 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, re-grindable 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, re-grindable seat as specified Section 23 05 23.01 - Valves - Bronze.
- .3 NPS 2-1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

2.7 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Forged Brass or Bronze body, Solid 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 ASME B16.18, Class 150.
 - .2 Bronze body, Solid 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.

2.8 BUTTERFLY VALVES

- .1 NPS 2-1/2 and over, wafer:
 - .1 To MSS-SP-67, Class 200.
 - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
 - .3 Lever operated, NPS 8 and over, gear operated.
- .2 NPS 2-1/2 and over, copper-tube dimensioned grooved ends:
 - .1 300 psig CWP, bubble tight shut-off, cast brass body aluminum-bronze disc, Fluoroelastomer pressure-responsive seat, with stainless steel stem. Stem offset from the disc centerline to provide complete 360-degree circumferential seating.
 - .2 Operator:
 - .1 NPS 4 and under: lever handle.
 - .2 NPS 6 and over: gear operated.

2.9 FRIDGE WATER LINE

- .1 to ASTM F877 and F280
- .2 PEX hose tubing c/w 304 stainless steel braided wire sized as per manufacturer's requirements. Surface finish: Cleaned, dehydrated, and capped to prevent contamination.

Part 3 Execution

3.1 PREPARATION

- .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 local authority having jurisdiction and National Plumbing Code.
- .2 Install pipe work in accordance with Section 23 05 15 – Installation of Pipework, supplemented as specified.
- .3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping 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 Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.
- .7 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .8 Valves:
 - .1 Isolate equipment, fixtures, and branches with gate/ball/butterfly valves. Valves shall be installed at the base of each riser and at each branch take-off.
 - .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

- .3 Install drain valves at each low point in piping systems and at each tank.
- .4 Provide blow-off valves on each 65 mm (2-1/2 inch) strainer and larger.
- .5 Install check valves as shown, and where required to prevent backflow.

3.3 FIELD QUALITY CONTROL

- .1 Pressure test buried systems before backfilling.
- .2 Pressure test systems in accordance with local regulations.

3.4 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.

3.5 FLUSHING & DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of Authority Having Jurisdiction and DCC Representative.
- .2 Coordinate with Section 33 11 16 and Section 33 11 16.01.

3.6 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 Commission water conditioners if applicable.
 - .4 Bring HWS storage tank up to design temperature slowly.
 - .5 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
 - .6 Check control, limit, safety devices for normal and safe operation.

- .4 Rectify start-up deficiencies.

3.7 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 HWC 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 HWS and HWC 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 off 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 13 – General Commissioning Requirements, 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.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM B32-08, Standard Specification for Solder Metal.
 - .2 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564-20a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - .4 ASTM C1053-00, Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
 - .5 ASTM D635-22, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 - .6 ASTM D1785-21a, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- .2 CSA Group
 - .1 CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CSA-B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CSA B125.3-18, Plumbing Fittings.
 - .4 CSA B181.3-18, Polyolefin and Polyvinylidene Fluoride (PVDF) Laboratory Drainage Systems.
 - .5 CSA B182.1-18, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .6 CSA B602-16, Mechanical Couplings for Drain, Waste, and Vent Pipe and Sewer Pipe.
- .3 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2020 (NPC).
- .4 ULC Standards
 - .1 ULC S115-2018, Standard Method of Fire Tests of Firestop Systems.
 - .2 ULC S102.2-2018, Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Provide manufacturer's printed product literature and datasheets, and include product characteristics, performance criteria, physical size, finishes, and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary and vent Type DWV: ASTM B306.
- .2 Fittings.
 - .1 Cast brass: CSA B125.3.
 - .2 Wrought copper: CSA B125.3.
 - .3 Solder: Lead free 95/5 tin antimony or lead free tin & silver solder to ASTM B32. Water soluble solder fluxes.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried storm, sanitary and vent minimum NPS 3: CAN/CSA-B70, black bituminous coating.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.ASTM C564 with Stainless steel clamps.
 - .2 Hub and spigot:
 - .1 Caulking: CSA B67.
 - .2 Cold caulking compounds.
- .2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
 - .1 Mechanical couplings for drain, waste, vent pipe and sewer pipe to meet the requirements of CSA B602.
 - .2 Joints:
 - .1 Hub and spigot:
 - .1 Caulking: to CSA B67.
 - .2 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.ASTM C564 with corrugated stainless steel sleeve band clamps.

2.3 PLASTIC PIPING AND FITTINGS

- .1 Buried or above ground storm, sanitary and vent PVC/DWV: to CSA B181.2, CAN/ULC S102.2
 - .1 Flame spread rating: not to exceed 25.
 - .2 Joints:
 - .1 PVC solvent weld:
 - .1 CSA certified
 - .2 Cements and primers to pipe manufacturer's recommendations.

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 pipework.
- .2 Install in accordance with National Plumbing Code.
- .3 Properly size vent stack covers for each vent penetrating roof. Division 23 to supply vent stack covers for installation and flashing by roofing contractor.
- .4 Seal pipes penetrating a fire separation by a fire stop system that, when subject to fire test method in CAN/ULC S115, has FT rating not less than the fire rating resistance of the fire separation.
- .5 Plastic piping:
 - .1 Do not use exposed in any egress corridors or stairs. Installation within rated enclosures acceptable.
 - .2 Do not use for drainage systems serving:
 - .1 Commercial kitchens
 - .2 Humidification systems
 - .3 Floor drains serving equipment which may discharge hot water such as boilers, hot water tanks, etc.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Pressure test systems in accordance with local regulations.

- .3 Hydraulically test to verify grades and freedom from obstructions.

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 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge, etc.) complete with directional arrows every floor or 4.5 metres, whichever is less.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA B51:19, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CSA C22.2 No.110:19, Electric Storage-Tank Water Heaters.
 - .3 CAN/CSA-C191-13(R2018), Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
 - .4 CSA-C309-M90 (R2019), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.
- .2 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2020 (NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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.

1.5 WARRANTY

- .1 For the Work of this Section, 12 months warranty period prescribed in General Conditions is extended to number of years specified for each product.

Part 2 Products

2.1 ELECTRIC WATER HEATER (HWT-7)

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309, with immersion type elements and surface mounted or immersion type adjustable thermostats.
- .2 Tank: glass lined steel, 25 mm fibreglass or foam insulation, enamelled steel jacket, 3-year warranty certificate.
- .3 Magnesium anodes adequate for 10 years of operation and located for easy replacement.
- .4 Refer to schedules for performance and size.

2.2 AIR SOURCE HOT WATER HEATER HEAT PUMP (HWT 1-6)

- .1 Air source hot water heater heat pump capable of heat pump only mode, hybrid, and electric only mode.
- .2 Tank: glass lined steel, 50mm Non-CFC foam insulation to cover the side and top of the tank
- .3 Air filters to be easily accessible and washable.
- .4 Magnesium anodes adequate for 10 years of operation and located for easy replacement.
- .5 Minimum 3.75 UEF
- .6 Refer to schedules for performance and size.

2.3 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, syphon, and shut-off cock.
- .4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .5 Magnesium anodes adequate for 10 years of operation and located for easy replacement.

2.4 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation on concrete support pad or structural steel support
- .2 Size anchor bolts to withstand seismic zone acceleration and velocity forces.

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.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .2 Waste Management: separate waste materials for [reuse] [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 CAN/CSA-B45 Series-02 (R2013), Plumbing Fixtures, (Consists of B45.0, B45.1, B45.2, B45.3, B45.4, B45.5, B45.6, B45.7, B45.8 and B45.9).
 - .2 CSA B125.3-18, Plumbing Fittings.
 - .3 CSA B651-18, Accessible Design for the Built Environment.
- .2 Green Seal (GS)
 - .1 GS-36-2021, Adhesives for Commercial Use.
- .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-A2011, Adhesive and Sealant Applications.

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 washroom fixtures and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 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.

1.3 CLOSEOUT SUBMITTALS

- .1 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.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CSA B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: as indicated on drawings.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.
- .7 Water closets:
 - .1 Water closet: 419 mm high, vitreous china, elongated bowl, white finish, floor mounted, 4.8 L (1.28 US Gal) per flush, 229 mm x 203 mm (9" x 8") water surface, Two (2) piece, lined tank, left hand trip lever, 51 mm (2") flush valve, 305 mm (12") rough-in, elongated bowl, 51 mm (2") trapway, floor outlet, bolt caps, Toilet seat not included.
 - .2 Seat: light duty, for elongated bowl closed front, solid plastic, with cover, soft close top mount hinges, plated steel posts and plastic nuts.
 - .3 NPS ½ cold commercial duty 1/4 turn ball valve angle stop, chrome finish with escutcheons. Chrome plated flexible metal, low lead riser supply.
 - .4 Floor Flange, brass or cast-iron floor flange, with all brass bolts and rubber gasket.
- .8 Washroom Lavatories:
 - .1 LAV-1: Counter Mount
 - .1 Basin: 3 holes, 4" (102 mm) center, 521 mm x 448 mm x 191 mm (20-1/2" x 17-5/8" x 7-1/2") high, Oval, Vitreous china, White Finish, Self-rimming / Drop-in, Front overflow, faucet ledge. Provide basin rim sealant.
 - .2 Trim: Single handle Faucet, Polished Chrome finish, Washerless 35 mm ceramic disc valve cartridge, 4.5 L/min (1.2 gal/min)

- aerator outlet, Metal spout, 127 mm (5") projection reach, Metal lever handles, Metal pop-up clicker style drain.
- .3 NPS ½ hot and cold commercial duty 1/4 turn ball valve angle stops, chrome finish with escutcheons. Chrome plated flexible metal, low lead riser supplies.
- .4 P-Trap, chrome plated, NPS 1-1/4 size, and escutcheon.
- .9 Fixture piping:
 - .1 Hot and cold water supplies to fixtures:
 - .1 Chrome plated flexible supply pipes with quarter-turn screwdriver stop, reducers, escutcheon.
 - .2 Waste:
 - .1 PVC P trap with clean out on fixtures not having integral trap.
 - .2 Chrome plated in exposed places.
- .10 Chair carriers:
 - .1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.
- .11 Janitor sink (JS-1)
 - .1 Mop Sink: 610 mm (24") wide x 610 mm (24") x 254 mm (10") high deep, floor mounted, molded stone, plain curbs, stainless steel drain with strainer, NPS 3 outlet
 - .2 Trim: Wall mount polished chrome-plated cast brass 203mm (8 in) sink faucet, low lead, short swivel inlets, 184 to 222 mm (7 1/4 to 8 3/4 in) adjustable centers, integral service stops, ceramic disc cartridges, polished chrome finish, 64 mm (2 1/2 in) vandal resistant color-coded lever handles, rigid spout with atmospheric vacuum breaker, wall brace, pail hook and hose threaded outlet, outlet at 232 mm (9 1/8 in) from finished wall.
 - .3 Accessories:
 - .1 Bumper Guard 610 mm (24") stainless steel.
 - .2 750mm (30") long flexible heavy duty 5/8" rubber hose, cloth reinforced with NPS 3/4 chrome coupling. Wall bracket is 125 mm long by 75mm stainless steel rubber grip.
 - .3 Mop Hanger 22 GA. (0.8 mm) type 304 stainless steel.
 - .4 Two (2) 610 mm (24") wide x 305 mm (12") high stainless steel back splash panels
 - .4 P-Trap same material as the connecting pipe drain. Provide service stops in accessible ceiling space.
- .12 Bathtub/ Shower (BT-1)
 - .1 Bath: 1-piece acrylic tub shower without roof cap integral shelf, dimensions of 1521 mm x 787 mm x 1880 mm (60" x 31" x 74"), Right or left hand outlet (according to plan), Alcove installation, Integral lumbar

- support, textured bottom surface, for below floor rough installation.
Provide suitable reinforcement to sub floor for all supports.
- .2 Universal Bath Drain: PVC/ ABS tubing with tap-actuated pop-up drain stopper. Chrome plated faceplate and closure mechanism. Provide P-Trap, same material as the connecting pipe drain.
 - .3 Pressure Balancing Shower Valve Trim: Polished Chrome finish, 191 mm (7-1/2") round shaped trim face plate, On/off, volume and temperature control single lever handle.
 - .4 Pressure Balancing In-Wall Shower Rough Valve: Cast brass body, 13 mm (1/2") universal inlet(s)/outlet(s), Ceramic disc valve cartridges, Integral hot water limit stop, Screw driver stops, Back-to-back capability.
 - .5 Shower Head: Polished Chrome finish, 5.7 LPM (1.5 GPM) max flow rate, Pressure compensating flow control device, 64 mm (2-1/2") face dia, Single function turbine drenching spray pattern, Easy clean spray nozzles.
 - .6 Shower Arm: Brass construction, 140 mm (5-1/2") long with 45 degree angle, Round escutcheon, Polished chrome finish.
 - .7 Bathtub shall be complete with Diverter Tub Spout, Polished Chrome finish, Slip-on for 1/2" (13mm) copper pipe, 121 mm (4-3/4") long.
- .13 Kitchen Sink – Double Compartment (KS-1)
- .1 Basin: Commercial double bowl countertop mount stainless steel sink, Stainless Steel, 304, 20 gauge, Silk finish, Topmount Commercial Sinks, Double compartment, 1 hole; 1 1/2" diameter; 1-1/2" (DN38) brass tailpiece, and standpipe with guard, Sink size: 520mm (20 1/2") L x 790mm (31 1/4") W and each bowl is 200mm (8") D x 360mm (14") W x 410mm (16") H, with faucet ledge, 3-1/2" crumb cup strainer, Center back waste location, Undercoated to reduce condensation and resonance, Factory applied rim seal, Certified to ASME A112.19.3-2008, Certified to CSA B45.4-08, Factory installed fasteners
 - .2 Trim: Pull-down kitchen faucet. 5.7L/min (1.5 gpm) Single control kitchen pull-down faucet. High arc brass swivel spout with pull down spray and metal lever handle. Polished Chrome finish, Center hole with optional deckplate, Aerator outlet, 199 mm (7-7/8") projection, Pull-down spray with adjustable spray pattern and pause feature, 10 mm (3/8") compression braided stainless steel flexible supply hose.
 - .3 NPS 1/2 hot and cold commercial duty 1/4 turn ball valve angle stops, chrome finish with escutcheons. Chrome plated flexible metal, low lead riser supplies.
 - .4 P-Trap, with dishwasher connection provision, PVC/ABS adjustable body, with slip nut, NPS 1- 1/2 size, box flange, and seamless tubular wall bend.
- .14 Dishwasher Connection
- .1 NPS 1/2 hot speedway stop, chrome finish.
 - .2 Hammer arrestor.

- .3 Make connection to sink P-trap.
- .15 Clothes Washer Connection
 - .1 Recessed washing machine outlet box equipped with 2 quarter turn valves for hot and cold-water line.
 - .2 Box: High impact polystyrene, watertight, white finish, with NPS 2 drain opening
 - .3 Hammer Arrestors: Mounted to valve, bellows type with welded stainless steel nesting bellows or piston style and stainless-steel casing. Air chambers are unacceptable.
 - .4 Valves: 1/4 turn hot and cold ball valve with metal handle.
- .16 Condensate Drain Connection
 - .1 Recessed ABS drain box.
 - .2 Drain box shall have a 5 8" integral test nipple on knockout. Drain connection shall be 2".
 - .3 Make connection to Clothes Washer standpipe drain
- .17 Domestic Water Recessed Valve Box
 - .1 Fire rated uninsulated access door and frame shall be fabricated from 16 gauge with a white powder coat primer. The door has continuous piano hinge. Frame shall be one piece construction with no mitres or welds on the face. Self latching tool-key operated latch / ring operated latch.

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 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied

3.2 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: as indicated, measured from finished floor.
 - .2 Wall-hung fixtures: as indicated, measured from finished floor.
 - .3 Barrier-free: per NBC.
- .2 Lavatory piping covers:
 - .1 Provide at all barrier free lavatories where piping is not concealed by a cover or millwork.

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 Adjust flush valves to suit actual site conditions.
 - .4 Adjust urinal flush timing mechanisms.
 - .5 Set controls of automatic flush valves for WCs and 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.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IES 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.2 SUBMITTALS

- .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. Include at minimum:
 - .1 Horsepower
 - .2 Voltage
 - .3 Frequency
 - .4 Speed
 - .5 Starting current and torque characteristics
 - .6 Full load current
 - .7 Class of insulation
 - .8 Enclosure type
 - .9 Service factor
 - .10 Ambient temperature reference
 - .11 Type of bearings
 - .12 Locations of connection box
 - .13 Manufacturer
- .2 Closeout Submittals
 - .1 Provide maintenance data for motors, drives, and guards for incorporation into O&M manual specified in Section 01 78 00 – Closeout Submittals.

Part 2 Products

2.1 GENERAL

- .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

- .1 Squirrel cage induction type unless otherwise specified.
- .2 Meet requirements of EEMAC and CSA standards for electrical motors, unless otherwise specified.
- .3 Speed: Nominal 1750 rpm, unless otherwise specified.
- .4 Provide motors with starting current-torque characteristics in accordance with EEMAC, Design B unless otherwise specified or unless load characteristics require higher starting torque. Provide motors with sufficient starting torque to start driven equipment and accelerate it to full speed within 10 seconds.
- .5 Unless noted otherwise, provide motors with Class B insulation, designed for continuous operation at 40°C (104°F). Motors controlled from variable speed drives to have Class H windings and Class F insulation.
- .6 Locate motor connection boxes on side of motor most easily accessible for maintenance and remote from belts, gears, or driven equipment. If boxes are factory installed on wrong side of motor, relocate boxes.
- .7 Circuit each multi-speed motor and associated switching device such that overload device in starter protects motor on each step of multi-speed switch. Alternatively, motor may have integral overload protection. Multi-speed motors to be single winding variable torque for 50% motor speed reduction and double winding, two speeds for other speed reductions.
- .8 Built-in overload protection for motors 0.375 kW (1/2 hp) and smaller.
- .9 Motors 22.4 kW (30 hp) and larger: Include heat detector protection embedded in windings for connection into motor control circuit.
- .10 Motor enclosures:
 - .1 If protected from weather and entraining moisture, use open drip-proof, service factor 1.15.
 - .2 Select motors located in air streams to operate satisfactorily at maximum temperature and moisture levels of surrounding air.
 - .3 For other locations, use totally-enclosed fan-cooled, service factor 1.0.
 - .4 Use explosion proof motors where scheduled.
- .11 Nameplates securely fastened in conspicuous places on motors.
- .12 Acceptable electric motor manufacturers:
 - .1 Canadian General Electric.
 - .2 Westinghouse.
 - .3 Lincoln.
 - .4 U.S. Motors.

- .5 WEG.
- .6 Baldor.

2.3 ELECTRONICALLY COMMUTATED (EC) MOTORS

- .1 DC electronic commutation type motor (ECM) specifically designed for fan or pump applications.
- .2 Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
- .3 Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
- .4 Motor shall be a minimum of 85% efficient at all speeds.
- .5 Motor enclosures:
 - .1 If protected from weather and entraining moisture, use open drip-proof
 - .2 Select motors located in air streams to operate satisfactorily at maximum temperature and moisture levels of surrounding air.
 - .3 For other locations, use totally-enclosed fan-cooled

2.4 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 10 HP [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 10 HP [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.

2.5 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm diameter 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 (1/16 inch) 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 (3/4 inch) 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 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Drives between motor and driven equipment to be provided with guards, except where casing acts as guard.
- .2 Guards for belt-driven equipment: Include hole for tachometer reading on each shaft.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2020 (NFC).

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data: Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment; include product characteristics, performance criteria, physical size, finishes, and limitations.

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

Part 2 Products

2.1 MATERIAL

- .1 Paint: Zinc-rich to CAN/CGSB-1.181.
- .2 Sealants: In accordance with Section 07 92 00 – Joint Sealants.
- .3 Firestopping: In accordance with Section 07 84 00 – Firestopping.

Part 3 Execution

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment, and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .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 automatic air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.

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.
- .4 Over NPS 2: Isolating flanges.

3.7 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts, and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes and remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use gate valves at branch take-offs for isolating purposes except where specified.
 - .7 Install butterfly valves on chilled water and related condenser water systems only.

- .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
- .9 Install ball valves for glycol service.
- .10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .15 Check Valves:
 - .1 Install silent check valves 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 - Firestopping.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.
- .3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Domestic Water Systems: Flush out, disinfect and rinse system to requirements of Authority Having Jurisdiction and DCC Representative.
- .2 Hydronic Systems: Flush in accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.
- .3 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 Pework: 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 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 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ASME B1.20.1-2013(R2018), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2021, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International (ASTM)
 - .1 ASTM A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283/B283M-22, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-22, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-25-2018, Standard Marking System for Valves, Fittings, Flanges, and Unions.
 - .2 MSS-SP-80-2019, Bronze Gate, Globe, Angle and Check Valves.
 - .3 MSS-SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends, Includes Errata (8-23-1010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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.

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 or grooved 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 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 B62.
 - .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.
 - .3 NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
 - .3 Operator: handwheel
 - .4 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 A276, loosely secured to stem.

- .3 Operator: handwheel.
 - .5 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 lockshield.
- .5 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections: screwed with hexagonal shoulders.
 - .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 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.
 - .4 NPS 2 and under, swing type, composition disc, Class 200:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
 - .5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
 - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
 - .2 Disc: renewable no. 6 composition PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
 - .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
 - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
- .6 Silent Check Valves:
 - .1 NPS 2 and under:
 - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .4 Disc and seat: renewable rotating disc.

- .5 Stainless steel spring, heavy duty.
- .6 Seat: regrindable.
- .7 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body: 2-Piece Dezincification Brass (DZR), with plain ends.
 - .2 Pressure rating: 2065-kPa CWP.
 - .3 Ball: chrome-plated brass stainless-steel, full port, blow-out-proof.
 - .4 Stem: chrome-plated brass stainless-steel.
 - .5 Seal: double EPDM O-ring.
 - .6 Seats: PTFE.
 - .7 Handles: zinc-plated carbon steel handle with orange vinyl grip.
- .8 Butterfly Valves:
 - .1 NPS 2 1/2 through NPS 6, 2068 kPa with grooved ends.
 - .1 Body: cast brass, with copper-tube dimensioned grooved ends.
 - .2 Disc: Aluminum-bronze.
 - .3 Stem: Stainless steel, offset from the disc centerline to provide complete 360-degree circumferential seating.
 - .4 Seat: Pressure responsive elastomer. (Grade to suit intended service.)
 - .5 Operator: handwheel lever.
- .9 Balancing Valves:
 - .1 NPS 1/2 through NPS 2, 1725 kPa with threaded or soldered ends.
 - .1 Body: DZR brass
 - .2 Disc: DZR brass
 - .3 Seat: EPDM.
 - .4 Operator: Multiple-turn handwheel for precise balancing.
 - .5 Pressure ports for measuring differential pressure and correlation to flow rate.

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 00 - Cleaning.

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2022, Power Piping.
- .2 ASTM International
 - .1 ASTM A125-96(2018), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .3 ASTM A563/A563M-21ae1, Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58-2018, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- .4 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2020(NPC).
- .5 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
 - .1 Structural assemblies and supports to be stamped and signed by professional engineer registered or licensed in the applicable Territory or Province of Canada.
- .4 Provide manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00- Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

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

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 SP-58.
 - .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 SP-58.

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 hangers, supports, brackets and other devices installed exterior to the building shall be galvanized to prevent failure from environmental corrosion. If galvanized components cannot be used submit samples of proposed substitute for review prior to installation.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Ensure steel hangers in contact with copper piping are epoxy coated or 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 carbon steel retaining clip.
 - .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, 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, to MSS SP-58.
 - .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.
- .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 6mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP-58.
- .5 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22mm or 28mm rod.
- .6 Pipe attachments: material to MSS SP-58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 For insulated piping:
 - .1 Oversize pipe hangers and supports to accommodate thermal insulation and to avoid penetrating the vapour retarder.
 - .2 bottom portion of insulation replaced with polyisocyanurate foam or equivalent.
 - .1 rated for required loading and minimum 300°F
 - .2 Assembly shall have a ULC Certified flame spread rating of not greater than 25, and asmoke developed classification of not more than 50
 - .3 Use insulation protection shields
- .7 Adjustable clevis: material to MSS SP-58, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.
- .9 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, with formed portion plastic coated.

- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP-58, type 42.
.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.
.3 Bolts: to ASTM A307.
.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

- .1 Curved plate 300 mm long to MSS SP-58, galvanized sheet carbon steel.
.2 64 kg/m³ density insulation with bottom portion of insulation replaced with polyisocyanurate foam or equivalent
.1 rated for required loading and minimum 300°F
.2 Assembly shall have a ULC Certified flame spread rating of not greater than 25, and a smoke developed classification of not more than 50.

2.6 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
.3 Provide upper and lower factory set travel stops.
.4 Provide load adjustment scale for field adjustments.
.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 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 2springs in series in single casing.
.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.10 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00.

2.11 ROOFTOP SUPPORTS

- .1 Bases - 100% Recycled Rubber, UV Resistant
- .2 Struts - 14 gauge Galvanized steel
- .3 Threaded Rods – 13mm electro-zinc plated

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 Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent undue stress to building structural components.
- .2 Suspending one hanger from another shall not be permitted.
- .3 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .4 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.
- .5 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .6 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

- .7 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.
- .8 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.
- .9 For special equipment supports refer to equipment sections. Where no support method is identified secure wall mounted equipment to metal framing or masonry, with steel toggle or expansion fasteners, machine screws or sheet metal screws as applicable. Plastic, fibre or soft metal inserts shall not be acceptable. Wall mounted equipment shall not exceed 45.5 Kg (100 lbs) in weight or 250mm (10") in depth unless reviewed or detailed by the Engineer's Representative. Where framing does not permit direct attachment, provide metal strut sub-framing or minimum 19mm (3/4 in.) fire retardant treated plywood backboards, unpainted, attached to the framing. Provide attachments for backboards at 600mm (24 in.) on centres with no less than 4 attachments.

3.3 ROOFTOP SUPPORTS

- .1 Provide non-penetrating supports for all rooftop equipment and piping as required.
- .2 For equipment or piping requiring penetrating supports fastened to the structure under the membrane, coordinate all penetrations with roofing provider to ensure a fully watertight installation.

3.4 HANGER SPACING

- .1 Plumbing piping: to National Plumbing Code of Canada (NPC).
- .2 Fire protection: to applicable fire code and authority having jurisdiction.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below 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.
- .6 Within 300mm 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	3.6 m

5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .7 Pipework greater than NPS 12: to MSS SP-58.

3.5 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.

3.6 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.

3.7 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.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

1.2 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .2 CSA Group
 - .1 CSA B149.1:20, Natural Gas and Propane Installation Code.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2019, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA (Fire) 14-2019, Standard for the Installation of Standpipe and Hose Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 DELIVERY, STORAGE, AND HANDLING

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

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.

- .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

- .1 Hazardous: red letters, white background.
.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

- .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

- .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.

.4 Locations:

- .1 Terminal cabinets, control panels: use size # [5].
.2 Equipment in Mechanical Rooms: use size # [9].

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
.2 Where existing identification system does not cover for new work, use identification system specified this section.
.3 Before starting work, obtain written approval of identification system from DCC Representative

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

- .1 Sprinklers: to NFPA 13.
.2 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive vinyl or 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
** Add design temperature		
++ Add design temperature and pressure		
City water	Green	CITY WATER
Brine	Green	BRINE
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold water supply	Green	DOM. CWS

Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

- .1 Identification in English and French.
- .2 Use one nameplate and label for each language.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

- .1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

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 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to DCC Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: Performed in accordance with requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2017, 7th Edition.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems - 1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) 1780, HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: Mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.2 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.3 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.4 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Perform TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.5 PRE-TAB REVIEW

- .1 Review Contract Documents before project construction is started. Confirm in writing to DCC Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to DCC Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.6 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.7 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by DCC Representative for verification of TAB reports.

1.8 START OF TAB

- .1 Notify DCC Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:

- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal, and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

1.9 APPLICATION TOLERANCES

- .1 Perform TAB to following tolerances of design values:
 - .1 HVAC systems: plus 5%, minus 5%.

1.10 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2% of actual values.

1.11 INSTRUMENTS

- .1 Prior to TAB, submit to DCC Representative list of instruments used together with serial numbers.

- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to DCC Representative.

1.12 SUBMITTALS

- .1 Submit, prior to commencement of TAB, proposed methodology and procedures for performing TAB if different from referenced standard.

1.13 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of DCC Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.14 TAB REPORT

- .1 Format report for clarity. Handwritten reports will not be accepted.
- .2 TAB report to show results in units to match schedules/drawings and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 3 copies of TAB Report to DCC Representative for verification and approval, English in D-ring binders, complete with index tabs.

1.15 VERIFICATION

- .1 Reported results subject to verification by DCC Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by DCC Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of DCC Representative.

1.16 SETTINGS

- .1 After TAB is completed to satisfaction of DCC Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

- .2 Following final acceptance of certified reports by DCC Representative, permanently mark settings of valves, dampers, splitters and other adjustable devices so that balance set position can be restored if disturbed. Do not mark such devices until after final acceptance.

1.17 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by DCC Representative.

1.18 SYSTEMS

- .1 Standard: TAB to most stringent of TAB standards of AABC, ASHRAE, or SMACNA.
- .2 The following systems to be tested and balanced:
 - .1 Air conditioning, ventilation and heating systems
 - .2 Miscellaneous ventilation or exhaust systems
 - .3 Air distribution (supply, return and exhaust)
 - .4 Split A/C units and condensers
 - .5 Chillers and chilled water distribution
 - .6 Boilers and heating systems
 - .7 Miscellaneous hydronic systems
 - .8 Water treatment systems
 - .9 Life safety and fire protection systems
 - .10 Plumbing systems
 - .11 All process piping including gas, air nitrogen and vacuum
- .3 Qualifications: Personnel performing TAB qualified and current member in good standing of AABC or NEBB.
- .4 Quality assurance: Perform TAB under direction of supervisor qualified to standards of NEBB or AABC.
- .5 Measurements: Include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.19 OTHER TAB REQUIREMENTS

- .1 Duct traverse readings to be taken through access ports provided. Where no access ports have been provided, make new holes as required. Reseal holes after final readings with sheet metal cover plates and sealant. Duct tape is not acceptable.
- .2 Where insulation is damaged repair it, including vapour barrier, in approved manner. Duct tape is not acceptable.
- .3 In cases where measurements show failure to comply with Drawings and Specifications, change fan sheaves, etc., as required, and make new TAB measurements.
- .4 Building pressure conditions: Adjust HVAC systems, equipment, controls to ensure building has overall positive pressure condition.
- .5 Zone pressure differences: Adjust HVAC systems, equipment, controls to establish indicated air pressure differentials, with systems in every possible combinations of normal operating modes.

1.20 TESTING/VERIFICATION OF FIRE PROTECTION EQUIPMENT

- .1 Test for proper operation of all smoke and fire dampers, installed as component parts of air systems specified Division 23.
- .2 Testing shall be performed after air balancing has been completed.
- .3 Test shall include following:
 - .1 Visual inspection of each device:
 - .1 Confirm appropriately rated device installed and CSA/ULC label affixed and visible through duct/ceiling access door.
 - .2 Confirm appropriate duct and/or ceiling access door provided to permit servicing of device. Confirm duct access door openable without interference from adjacent ceiling, pipes, ducts, etc.
 - .3 Confirm device has been installed in accordance with requirements of the specifications, manufacturer's instructions and codes.
 - .4 Confirm proper installation, clearances, use of proper angle framing, use of proper fasteners, use of fire rated material in wall opening, location of breakaway joints etc.
 - .5 Confirm that device has not been painted.
 - .2 Operational inspection of each device to include:
 - .1 Manual release of fusible link allowing device to close. Confirm tight fit closure without binding.
 - .2 Confirm that appropriate fusible link is installed.
 - .3 Re-open device and reset fusible link connection.

- .3 Following requirements are in addition to the above noted testing requirements and shall apply to all motorized smoke and fire/smoke dampers, including all motorized dampers associated with smoke control systems:
 - .1 Associated fan system shall be operating as per normal conditions.
 - .2 Power to operator shall be applied/removed, as required, to cause damper to open. Ensure full opening operation without binding or overdriving of operator.
 - .3 Power to operator shall be removed/restored, as opening operation without binding or overdriving of operator.
 - .4 Ensure damper closes/opens against associated fan operating static pressure.
 - .5 Ensure proper adjustment of all damper drive linkages for fully open and fully closed positions and operation through full range without binding.
 - .6 Ensure proper device configuration e.g. power-to-open or power-to-close as specified.
- .4 Provide verification report on completion of work. Report shall indicate general location (e.g. room number or description) and specific location (e.g. north wall above ceiling) of access door to device. Report shall include itemized verification of following, as appropriate, for each device:
 - .1 Device is fully accessible.
 - .2 Device has been properly installed
 - .3 Device has been successfully tested.
 - .4 Device has been reset.
 - .5 Name of tester.
 - .6 Date device tested successfully.

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 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IES 90.1-2013, SI Edition; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International
 - .1 ASTM B209/B209M-21a, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM C335/335M-17, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07(2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-22a, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC)
 - .1 National Insulation Standards.
- .5 ULC Standards
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

- .2 "EXPOSED" - means "not concealed" as previously defined.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .4 TIAC Codes:
- .5 CRD: Code Round Ductwork,
- .6 CRF: Code Rectangular Finish.

1.3 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 duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Description of equipment giving manufacturer's name, type, model, year, and capacity.
 - .3 Details of operation, servicing, and maintenance.
 - .4 Recommended spare parts list.
- .3 Manufacturers' Instructions:
 - .1 Provide manufacture's written duct insulation jointing recommendations and special handling criteria, installation sequence, cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: Specialist in performing work of this section qualified to standards.

1.5 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 To CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

- .1 Canvas: 220 g/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: Compatible with insulation.
- .3 Aluminum: To ASTM B209, with moisture barrier as scheduled in PART 3 of this section.
 - .1 Thickness: 0.50 mm sheet.
 - .2 Finish: Corrugated.
 - .3 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: [hydraulic] setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m²cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: Self-adhesive, aluminum, reinforced, 75 mm wide minimum.

- .7 Contact adhesive: Quick-setting.
- .8 Canvas adhesive: Washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation.
- .12 Fasteners: pins with clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 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 2 rows each side.

- .7 Coordinate to ensure duct insulation is applied prior to ductwork being installed to underside of slabs, beams or other services or behind other duct risers and shafts.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold supply air ducts	C-1	yes	25
Round cold supply air ducts	C-2	yes	25
Rectangular warm air ducts	C-1	no	25
Round warm air ducts	C-2	no	25
Supply, return and exhaust ducts exposed in space being served	none		
Exhaust duct 6ft back of outlet	C-1	yes	50
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-2	special	50

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials 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 Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IES 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International
 - .1 ASTM B209/B209M-21a, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335/335M-17, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07(2019), Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-17, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-22a, Standard Specification for Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-08(2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1999, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .7 ULC Standards

- .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CAN/ULC-S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- .4 CAN/ULC-S702.2-15, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

1.2 DEFINITIONS

- .1 For purposes of this section:
 - .1 CONCEALED - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 EXPOSED - will mean "not concealed" as specified.
- .2 TIAC:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

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 datasheets; include product characteristics, performance criteria, and limitations.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: Specialist in performing work of this Section

1.5 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 Burning characteristics: In accordance with CAN/ULC-S102.
 - .1 Flame spread: Maximum 25.
 - .2 Smoke developed: Maximum 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.
- .3 TIAC Code A-1: Rigid moulded mineral fibre with factory applied all-service jacket.
 - .1 Mineral fibre: To CAN/ULC-S702.
 - .2 Maximum "k" factor: To CAN/ULC-S702.
- .4 TIAC Code A-3: Rigid moulded mineral fibre with factory-applied vapour retarder jacket.
 - .1 Mineral fibre: To CAN/ULC-S702.
 - .2 Jacket: To CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: To CAN/ULC-S702.
- .5 TIAC Code C-2: Mineral fibre blanket faced with factory-applied vapour retarder jacket.
 - .1 Mineral fibre: To CAN/ULC-S702.
 - .2 Jacket: To CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: To CAN/ULC-S702.
- .6 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket to ASTM C534 unless Water Vapor Permeability is below $0.725 \times 10^{-13} \text{ Kg}/(\text{s} \cdot \text{m} \cdot \text{Pa})$
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: 0.039 W/mK.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement: As recommended by insulation manufacturer

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: White.
 - .3 Minimum service temperature: -20°C.
 - .4 Maximum service temperature: 65°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape in matching colour.
 - .7 Special requirements:
 - .1 Outdoor: UV rated material at least 0.5 mm thick.
- .2 Canvas:
 - .1 220 g/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.
- .3 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Stucco embossed.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

- .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: Stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking: Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions as specified.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers: Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- .6 Terminate insulation on pipes passing through fire rated walls or floors, and fit tight to firestop material.
- .7 Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, to be insulated with removable caps or sections. Seal edges between pipe and vapour barrier and held in place with stainless steel straps. Finish insulation smooth, making outline of pipe insulation true circular and

concentric shape. Shape outline of fitted insulation to blend with adjacent covering.

- .8 On cold water service valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges and other irregular shaped objects, apply flexible elastomeric sheet insulation, thickness to suit service, cut and mitre as necessary, and attach with adhesive and stainless steel banding. Bond and seal edges of insulation to adjacent surfaces, provide vapour retarder.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
- .2 Design: to Permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings, and finishes: Same as system.
 - .2 Jacket: Provide material as required for temperature of system: PVC, aluminum, high temperature fabric, ABS.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlap to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: Wire at 300 mm on center.
 - .2 Seals: Lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: Stainless steel bands at 300 mm on center.
 - .2 Protection: Sheet steel shields at each hanger or support.
 - .3 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .4 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
 - .1 Securements: Adhesive applied to both joining surfaces.

- .2 Seals: Lap seal adhesive, lagging adhesive.
- .5 TIAC Code: C-2 with all service jacket.
 - .1 Securements: Wire at 300 mm on center.
 - .2 Seals: Lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 Thickness of insulation as listed in following table.
 - .1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)		
Run out			to 1	1 1/4 to 2	2 1/2 to 4
Domestic HWS	all	A-1	25	25	38
Refrigerant hot gas, liquid, suction	4 - 13	A-6	25	25	25
Refrigerant liquid, suction, hot gas	below 4	A-6	25	25	38

- .7 Finishes:
 - .1 Exposed indoors: PVC jacket.
 - .2 Exposed in mechanical rooms: PVC jacket.
 - .3 Concealed, indoors: none
 - .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .5 Outdoors: aluminum jacket.
 - .6 Finish attachments: SS bands at 150mm on centre. Seals: closed.
 - .7 Installation: To appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This is a performance specification for the provision all labour, materials, products, equipment and services to supply, install, test and commission the control system for building mechanical and electrical systems and interface with other microprocessor-based building subsystems as indicated on drawings and described herein.
- .2 Work referred to above consists of fully operational control systems, including, but not limited to, following:
 - .1 Development of I/O Points list based on drawings, sequence of operations.
 - .2 Controllers and control panels
 - .3 Control devices as required by I/O point list.
 - .4 Field control devices and sensors.
 - .5 Field wiring.
 - .6 Programming.
 - .7 Complete operating and maintenance manuals.
 - .8 Training of personnel.
 - .9 Acceptance tests, technical support during commissioning, full documentation.
 - .10 Wiring interface co-ordination of equipment supplied by others.
 - .11 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.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE 135-2020, BACnet - A Data Communication Protocol for Building Automation and Control Networks (ANSI Approved).
- .2 CSA Group
 - .1 CSA C22.1-18, The Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for electric and electronic control system for HVAC; include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Shop drawings:
 - .1 Detailed system architecture showing all points associated with each controller.
 - .2 Wiring diagrams.
 - .3 Controller locations.
 - .4 Complete description of sequence operation.
- .4 Certificates: 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 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 electric and electronic control systems from damage.
 - .3 Replace defective or damaged materials with new.

1.5 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.
- .2 Provide as-built copy of shop drawings detailing changes to Contract Documents as well as addenda and contract extras

1.6 COMMISSIONING

- .1 Participate in commissioning process in accordance with Section 01 91 13 - General Commissioning Requirements.

Part 2 Products

2.1 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant.
- .3 Operating conditions: 0 – 40 degrees C with 10- 90% RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in NEMA 4enclosures.
- .8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 THERMOSTAT (LOW VOLTAGE)

- .1 LCD display with space temperature and temperature setpoint
- .2 Heat, Cool and Auto modes
- .3 Fan speed selector with Auto mode
- .4 Buttons for occupant selection of setpoints
- .5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.
- .6 Stability 0.02 degrees C drift per year.

2.3 HUMIDISTAT (HRV CONTROLLER)

- .1 LCD display and Buttons for occupant selection of setpoints.
- .2 Fan speed selector with Auto mode, continuous fan mode and timer options.
- .3 Humidity control through adjustable Dehumidistat
 - .1 Range: 5 - 90 % RH minimum.
 - .2 Operating temperature range: 0 - 60 degrees C.

- .3 Absolute accuracy: plus or minus 2 %.

2.4 TIMER SWITCH (HRV OVERRIDE CONTROLLER)

- .1 Switch to be located in the bathroom suites.
- .2 Three timer options – 20/ 40/ 60 minutes

2.5 TEMPERATURE SENSORS

- .1 General: except for room sensors, to be resistance or thermocouple type to following requirements:
 - .1 Thermocouples: limit to temperature range of 200degrees C and over.
 - .2 RTD's: 100 or 1000 ohm at 0degrees C (plus or minus 0.2ohms) platinum element with strain minimizing construction, 3integral anchored leadwires. Coefficient of resistivity: 0.00385ohms/ohm degrees C.
 - .3 Sensing element: hermetically sealed.
 - .4 Stem and tip construction: copper or type 304 stainless steel.
 - .5 Time constant response: less than 3 seconds to temperature change of 10degrees C.
 - .6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor.
- .2 Room temperature sensors
 - .1 Wall mounting, in slotted type covers having brushed stainless steel finish.
 - .2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2 degrees C.
- .3 Duct temperature sensors:
 - .1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length as required for sufficient contact with process fluid to measure average conditions.
 - .2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6000mm. Bend probe at field installation time to 100mm radius at point along probe without degradation of performance.
- .4 Outdoor air temperature sensors:
 - .1 Outside air type: complete with probe length 100 - 150mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13mm conduit, weatherproof construction in NEMA 4 enclosure.

2.6 THERMOSTAT GUARDS

- .1 Thermostat guards: lockable clear plastic. Slots for air circulation to thermostat.

2.7 LOW LIMIT TEMPERATURE ALARM

- .1 Low limit temperature alarm with:
 - .1 Rating: 10.2 A at 120 V.
 - .2 Sensing bulb and long capillary tube.
 - .3 Switching action: manual.
 - .4 Temperature setting range: 0°C to 15°C.

2.8 HIGH LIMIT TEMPERATURE ALARM

- .1 High limit temperature alarm with:
 - .1 Rating 10 A at 120 V.
 - .2 Positive lock-out.
 - .3 Manual reset only after 14 degrees C drop-in temperature.
 - .4 Cut-out setting: 50°C.

2.9 FLOW SWITCH

- .1 Flow switch for pipe size as indicated, CSA Enclosure. Maximum liquid temperature: 121°C. Maximum liquid gauge pressure of 1034 kPa ambient temperature range 4°C to 80°C.

2.10 PRESSURE SWITCH

- .1 Pressure switch for water or air with reset, contacts auto on rise. Full load 1.2A at 24V. ULC rated.

2.11 STATIC PRESSURE SENSORS

- .1 Requirements:
 - .1 Multipoint element with self-averaging manifold.
 - .1 Maximum pressure loss: 160Pa at 10m/s. (Air stream manifold).
 - .2 Accuracy: plus or minus 1% of actual duct static pressure.

2.12 DOMESTIC WATER METERS

- .1 Electric contacting positive displacement meters with a Reed Switch
- .2 Reed Switch: Dry contact type, normally open, 24V, 100mA maximum
- .3 Pressure Rating: 30 - 150 psi.
- .4 Temperature Range: 35° - 105°F. Protect the meter from freezing.
- .5 PH Level Range: 6.5 – 8.0
- .6 Accuracy: +/- 1.5% of maximum flow when operating between minimum and maximum flow range.

2.13 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 Operating range: 0 - 10 V DC or 4 - 20 mA DC.

2.14 CURRENT SWITCHES

- .1 Current-operated switches shall be self-powered, solid-state with adjustable trip current.

2.15 WIRING

- .1 As per requirements of Division 26.
- .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: Stranded 18 gauge copper twisted shielded.
 - .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.

2.16 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 Auxiliary Control Devices:

- .1 Auxiliary contacts: one "Normally Open" and one "Normally Closed" spare auxiliary contact in addition to maintained auxiliary contacts as indicated.
- .2 Hand-Off-Automatic switch: heavy duty type, knob lever operator.
- .3 Double voltage relays: with barrier to separate relay contacts from operating magnet. Operating coil voltage and contact rating as indicated.

2.17 POWER SUPPLIES

- .1 Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
 - .1 DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
 - .2 Unit shall operate between 0°C and 50°C (32°F and 120°F).
 - .3 Line voltage units shall be UL recognized and CSA listed.

2.18 CONTROL PANELS

- .1 All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
- .2 Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
- .3 Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.19 CONTROLLERS

- .1 Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC) and Application Specific Controllers (ASC) as required to achieve performance specified by system performance. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L.
- .2 Controllers shall be listed in the BACnet Testing Laboratories (BTL) Product Listing.

Part 3 Execution

3.1 GENERAL

- .1 Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- .2 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- .3 Install equipment in readily accessible locations. Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
- .4 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

3.2 WIRING

- .1 All control and interlock wiring shall comply with CSA 22.1 Canadian Electrical Code, local electrical codes, and Division 26 of this specification, Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.
- .2 All Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.
- .3 All low-voltage wiring shall meet Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.
- .4 Where Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.
- .5 All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 3 m (10ft).
- .6 Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
- .7 Do not install wiring in raceway containing tubing.
- .8 Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.
- .9 Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

- .10 All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- .11 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- .12 Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
- .13 All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- .14 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- .15 Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.
- .16 Include one pull string in each raceway 2.5 cm (1 in.) or larger.
- .17 Use color-coded conductors throughout with conductors of different colors.
- .18 Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- .19 Conceal all raceways except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues).
- .20 Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- .21 Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.
- .22 Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.
- .23 The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- .24 Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to

moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

- .25 Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.3 COMMUNICATION WIRING

- .1 The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.
- .2 All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling
- .3 Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.
- .4 Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- .5 Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
- .6 When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to manufacturer's instructions.
- .7 All runs of communication wiring shall be unspliced length when that length is commercially available.
- .8 All communication wiring shall be labeled to indicate origination and destination data.
- .9 Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
- .10 BACnet IP, Arcnet, or MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135.

3.4 INSTALLATION

- .1 Install all control devices in accordance with manufacturer's instructions.
- .2 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .3 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

- .4 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.5 EXISTING CONDITIONS

- .1 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- .2 Cutting and Patching: refer to Section 01 73 00 - Execution supplemented as specified herein.
- .3 Repair all surfaces damaged during execution of work.

3.6 IDENTIFICATION

- .1 Use colour coded wiring in communications cables, matched throughout system, to CSA C22.1.
- .2 Identify circuit breaker panel/circuit breaker number inside each BAS panel.
- .3 install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets, and outlet boxes.

3.7 CONTROLLERS

Provide a stand-alone controller for each heat pump or other HVAC system. The controller may control more than one system provided that all points associated with the system are assigned to the same controller. 2. The controller shall be selected to provide the required sequence of operation.

3.8 SEQUENCES OF OPERATION

- .1 General
 - .1 Provide all labour, materials, products, equipment, and services to sequence mechanical equipment as described below.
 - .2 Points listed below are a minimum. If points not listed are required to achieve described sequence of operation, such points shall be provided at no additional cost to the contract.
- .2 Individual Suites
 - .1 Heat Recovery Ventilator (HRV-##)
 - .1 The HRV shall operate and maintain the space humidity setpoint at the humidistat (HS) and bathroom switch.
 - .2 Heat Pump (HP-##)
 - .1 The HP shall operate to maintain the space temperature at the setpoint temperature indicated on the thermostat (TS) via the Heat Pump Controller (HPC). If HP operates up to 100% heating and is

unable to meet setpoint temperature for 120 seconds (adjustable), the HPC shall command the electric duct coil (EDC) to operate to increase supply air temperature to meet the temperature setpoint as indicated on the thermostat (TS).

.3 Corridors

.1 Electric Reheat Coil EDC-8

- .1 EDC-8 shall operate to keep the outgoing air temperature above 0°C (adjustable), as per the air temperature sensor T1.

.2 Heat Pump (HP-7)

- .1 HP-7 shall operate to maintain the space temperature indicated in the thermostat (TS) via the Heat Pump Controller (HPC). If HP-7 operates up to 100% heating and is unable to meet setpoint temperature for 120 seconds (adjustable), the HPC shall command the Electric Duct Coil EDC-7 to operate to increase supply air temperature to meet temperature setpoint as indicated on the thermostat (TS).
- .2 When Heat Pump HP-7 is in operation, Motorized Damper MD will remain in the open position. The fan within Heat Pump HP-7 cannot operate until Motorized Damper MD is confirmed open via the end switch on the damper.
- .3 In the event that Heat Pump HP-7 fails or is not in operation, Motorized Damper MD shall remain closed and EDC-7 and EDC-8 shall be deactivated.

3.9 SYSTEM CHECKOUT AND STARTUP

- .1 Inspect each termination in the control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.
- .2 After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points.
- .3 Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic startup.
- .4 After all of the points are verified, and power is available to the mechanical system, coordinate a startup of each system with the mechanical contractor. Include the following tests:
- .1 Start systems from user operation location (thermostat, switch, etc.).
- .2 Verify that each setpoint can be met by the system.
- .3 Change setpoints and verify system response.
- .4 Test safety shutdowns.
- .5 Verify time delays.
- .6 Verify mode changes.

- .7 Adjust filter switches and current switches for proper reactions.

3.10 SYSTEM COMMISSIONING, DEMONSTRATION AND TURNOVER

- .1 The Contractor shall prepare and submit for approval a complete acceptance test procedure including submittal data relevant to functions, sequence, inter-locks, and associated parameters, and other pertinent information for the operating system. Prior to acceptance by the DCC Representative, the Contractor shall completely test the Controls systems using the approved test procedure.
- .2 When the system performance is deemed satisfactory in whole or in part by the DCC Representative, the system parts will be accepted for beneficial use and placed under warranty.

3.11 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards - Metal and Flexible.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories; include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .1 Indicate:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.

1.3 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.

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 with fabric clenched by means of double locked seams.
- .2 Material: Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at - 40°C to + 90°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.
 - .6 300 x 300 mm glass viewing panels.

2.4 TURNING VANES

- .1 Factory or shop fabricated single thickness to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST PORTS

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

2.6 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 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 Minimum 450 x 450 mm.
 - .2 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 As indicated.
 - .5 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 As indicated.
- .4 Turning Vanes:

- .1 Install in accordance with recommendations of SMACNA and as indicated.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal and Flexible.

1.2 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 dampers; include product characteristics, performance criteria, physical size, finishes, 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 dampers for incorporation into O&M manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: Piano hinge.

- .6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside bronze or nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: self-lubricating nylon or pin in bronze bushings.
- .5 Linkage: Shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

Part 3 Execution

3.1 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.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Air Movement and Control Association International (AMCA)
 - .1 AMCA 511-21, Certified Ratings Program - Product Rating Manual for Air Control Devices.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for dampers; 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 dampers for incorporation into O&M manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, leaf, aluminum construction. Blades joined with tie bar, with rust-proof shafts rotating in bronze bushings. Counterweighted or spring assisted as required.

2.2 MULTI-LEAF DAMPERS

- .1 Sizing:
 - .1 Dimensions: As indicated. Maximum damper section: 1200 x 1500 mm (48 x 60 inches). For dampers larger than section maximum, use assembly of multiple, equally sized sections.
- .2 Blade Type:
 - .1 Two-position: Parallel blade.
 - .2 Modulating: Opposed blade.

- .3 Frame:
 - .1 Extruded aluminum
 - .2 2.0mm thick
 - .3 Extruded silicone frame seals
- .4 Blades:
 - .1 Extruded aluminum with air-foil profile
 - .2 1.5mm thick
 - .3 Extruded EPDM blade seals
- .5 Insulated dampers:
 - .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
 - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.
 - .3 Blade seals: extruded silicone
- .6 Pressure fit self-lubricated bronze bearings.
- .7 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .8 Drive Shaft: Corrosion resistant steel of square or hexagon shape.
- .9 Leakage: Maximum 0.35 L/s/m² (8 cfm/sq ft) at 1.0 kPa (4 inch wg) of differential pressure across fully closed damper when tested to AMCA Standard 511.

Part 3 Execution

3.1 INSTALLATION

- .1 Install where indicated.
- .2 All dampers located at penetrations to outdoors or unconditioned areas to be insulated type.
- .3 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .4 Seal multiple damper modules with silicon sealant.
- .5 Install access door adjacent to each damper. See Section 23 33 00- Air Duct Accessories.
- .6 Ensure dampers are observable and accessible.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Air Movement and Control Association International (AMCA)
 - .1 ANSI/AMCA 500-D-12, Methods of Testing Dampers for Rating.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2021 Edition.
- .3 ULC Standards
 - .1 CAN/ULC-S112-10, Standard Test Method of Fire Test of Fire Damper Assemblies.
 - .2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
 - .3 ULC-S505-74, Standard for Fusible Links for Fire Protection Service.
- .4 Underwriters Laboratories (UL)
 - .1 UL 555-2006, Fire Dampers.
 - .2 UL 555C-2014 Ceiling Dampers.

1.2 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 fire and smoke dampers and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Smoke dampers.
 - .3 Fire stop flaps.
 - .4 Operators.
 - .5 Fusible links.
 - .6 Design details of break-away joints.

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 fire and smoke dampers for incorporation into manual.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials: Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Provide:
 - .1 6 fusible links of each type.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Products

2.1 FIRE DAMPERS

- .1 The fire-protection rating shall be determined in accordance with CAN/ULC-S112.
- .2 Curtain type, rated as 'Dynamic', with blades clear of air stream. Fire dampers to be Type B or Type C as required to suit system air velocity and pressure. Dampers to be multi-sectional as required to suit size and ULC Listing requirements.
 - .1 Where specified curtain fire dampers are limited by ULC Listing for maximum size, substitute with multi-blade type complete with power actuation and/or fusible link as required to satisfy fire rating of partition.
- .3 Fire-stop flaps or ceiling mounted fire dampers: As shown in Underwriters Laboratories Listing for specific ceiling assembly used.

Part 3 Execution

3.1 INSTALLATION

- .1 Install fire dampers where shown and at penetrations through fire rated assemblies. Fire dampers shown in grilles or diffusers at ceiling level are to be firestop flap. Obtain local authorities' approvals for damper locations and keep one set of marked-up prints on site. Obtain approvals before installation of fire dampers.
- .2 Where fire dampers for ducts shown on Drawings require change of type and/or powered actuation due to dimension limitations to satisfy ULC Classification requirements, provide transitions as required to adjust duct dimensions while maintaining equivalent circular duct diameter to avoid exceeding any specific listed maximum dimension. Where transitions are not possible or dimensions

cannot be adjusted to avoid powered actuation, provide power from closest available emergency power source as required. Review conditions with DCC Representative in advance of fabrication.

- .3 Install fire dampers in accordance with NFPA 80, NFPA 90A and in accordance with conditions of ULC listing.
- .4 Maintain integrity of fire separation.
- .5 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .6 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .7 Co-ordinate with installer of firestopping.
- .8 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .9 Install break-away joints of approved design on each side of fire separation.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials 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 Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 90A, Installation of Air-Conditioning and Ventilating Systems, 2021 Edition.
 - .2 NFPA (Fire) 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems, 2021 Edition.
- .3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
 - .1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 2008.
- .4 Underwriters Laboratories (UL)
 - .1 UL 181-2013, Factory-Made Air Ducts and Air Connectors.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S110-13, Standard Methods of Test for Air Ducts.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturers' instructions, printed product literature, and data sheets for flexible ducts; include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .1 Indicate:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.
- .3 Test and Evaluation Reports: Catalogue or published ratings obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 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 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 flexible ducts from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC-S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating maximum 25. Smoke developed rating maximum 50.

2.2 METALLIC - UNINSULATED

- .1 Spiral wound flexible aluminum, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
- .3 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Frequency (Hz)					
Duct Diam:	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

Part 3 Execution

3.1 DUCT INSTALLATION

- .1 Install in accordance with SMACNA.
- .2 Ensure installed lengths of flexible ductwork are no longer than 1.5 m (5 feet) when fully stretched.
- .3 Flexible ductwork may be used under the following conditions:
 - .1 Use flexible ductwork where shown to allow easy location of diffusers.
 - .2 Flexible ductwork shall not pass through floors or fire walls,
 - .3 Flexible ductwork to be single section of duct, no joints. If building construction requires connection between lengths of flexible duct, use rigid section of duct as joint. Secure flexible duct to rigid section using ties and sealant.
 - .4 Provide durable elbow support where flexible ducts bend as an elbow.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Air Movement and Control Association (AMCA)
 - .1 ANSI/AMCA 99-2016, Standards Handbook.
 - .2 ANSI/AMCA 210-2016. Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 ANSI/AMCA 300-2014, Reverberant Room Method for Sound Testing of Fans.
 - .4 ANSI/AMCA 301-2014, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for HVAC fans; include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Shop Drawings:
 - .1 Indicate:
 - .1 Motors, sheaves, bearings, shaft details.
 - .2 Minimum performance achievable with variable speed controllers.
 - .2 Fan performance curves showing point of operation, kW, bhp and efficiency.
 - .3 Sound rating data at point of operation.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials: Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide:
 - .1 Matched sets of belts.
 - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
 - .1 Bearings and seals.
 - .2 List of specialized tools necessary for adjusting, repairing, or replacing.

1.4 DELIVERY, STORAGE AND HANDLING

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

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 in force.
 - .2 Capacity: Flow rate, static pressure, bhp, efficiency, revolutions per minute, power, model, size, and sound power data as indicated on fan schedule.
 - .3 Fans: Statically and dynamically balanced, constructed in conformity with ANSI/AMCA 99.
 - .4 Sound ratings: Comply with ANSI/AMCA 301, tested to ANSI/AMCA 300. Supply unit with ANSI/AMCA certified sound rating seal.
 - .5 Performance ratings: Based on tests performed in accordance with ANSI/AMCA 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.
 - .6 Classification for Spark Resistant Construction: Conform to ANSI/AMCA 99.

2.2 FANS GENERAL

- .1 Motors:
 - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified.
 - .2 Sizes as indicated.
- .2 Accessories and hardware: Matched sets of V-belt drives, adjustable motor bases, belt guards, coupling guards fan inlet and outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: As indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Flexible connections: Section 23 33 00 - Air Duct Accessories.

2.3 RANGE HOOD (RH-1)

- .1 759.5mm (29.9in) x 509mm (20.06in) x 128mm (5.05in) stainless steel cabinet kitchen range hood fan c/w motor capable of 3- speeds, LED lighting, grease filter.
- .2 Range hood to be equipped with integral damper
- .3 Minimum blower capacity 118 L/s (250 cfm); Maximum blower capacity 177 L/s (450 cfm)
- .4 Maximum loudness (sone): 1.5 at normal speed (Low) and 6.0 sonas at maximum speed (High).
- .5 Home Ventilating Institute (HVI) certified.

2.4 DRYER EXHAUST FAN (DEF-1)

- .1 General
 - .1 HVI 916 certified
 - .2 Conforms to CSA standard C22.2-113
 - .3 Supports exhaust runs up to 125 linear feet
 - .4 Two (2) 4-inch cleanouts included
- .2 Casing
 - .1 Heavy gauge, galvanized sheet metal
 - .2 Inlet/Outlet:
 - .3 One 4-inch inlet port
 - .4 One 4-inch outlet port
- .3 Electrical
 - .1 Completely enclosed, electrical wiring box with pre-wired terminal strip connections
- .4 Motor
 - .1 120V, permanent, split-capacitor type
 - .2 Motorized impeller
 - .3 Composite material
 - .4 Statically and dynamically balanced as one integral unit
 - .5 Permanently sealed, self-lubricating, ball-bearing type
 - .6 Equipped with automatic reset thermal overload protection
 - .7 Acceptable for continuous duty
 - .8 Sufficient service factor shall be provided to ensure long, maintenance-free operation over maximum load conditions
- .5 Pressure-sensing switch

- .1 Constructed of galvanized sheet metal
- .2 Integral delay-on-break timer cycles fan on for intervals of 10 minutes
- .3 Activates after sensing positive pressure
- .4 Air temperature limit safety cutoff:
- .5 Integral thermal fuse
- .6 Indicator Panel
 - .1 Shows product status
 - .2 Connected by a 50-foot cable
 - .3 LED light
 - .4 Color: Blue
- .7 Accessories
 - .1 Secondary Lint Trap
 - .1 Constructed of galvanized, sheet metal
 - .2 4-inch inlet and outlet
 - .3 Internal screen to filter dryer lint
 - .4 Not intended for use with gas dryers

Part 3 Execution

3.1 FAN INSTALLATION

- .1 Install fans as per manufacturer's instructions, complete with resilient mountings, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible. Where it is difficult to provide such access, provide extended lubrication lines. When such lines extend to pillow block bearings, provide grease relief valve.
- .4 Align shafts, belt drive and motor, adjust belt tension, ensure set screws are tight and check motor rotation before start-up.
- .5 Install access doors and access panels to be easily accessible.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

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END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 70-2006 (RA2011), Method of Testing the Performance of Air Outlets and Air Inlets (ANSI approved).

1.2 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 diffusers, registers and grilles; include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Indicate:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .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.

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.

Part 2 Products

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Concealed manual volume control damper operators.
- .3 Colour: as indicated
- .4 Noise generated by diffusers to be such that room sound pressure level does not exceed noise criteria 30 with 8 dB room attenuation, sound power level reference to 10 to –12 power watts.
- .5 Volume and air pattern devices to be fully adjustable from face of diffuser, register, or grille.
- .6 In gypsum board or plaster ceiling applications:
 - .1 Provide matching mounting frame with prime painted, off-white finish.
 - .2 Provide face adjustable opposed blade damper
- .7 In T-bar ceilings, coordinate diffuser compatibility with T-bar ceiling specified by Architectural. Diffusers to suit ceiling grid as required, imperial or metric.
- .8 Diffusers to meet test requirements of ASHRAE 70, including air pattern and noise levels for air quantities from 10% to 110% of required maximum air flow. Sound power tests to be measured in accordance with ASHRAE 70 and NC ratings determined using an 8 dB room attenuation factor.
- .9 All painted products to have baked-on powder coat finish. The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
 - .1 The paint film thickness shall be a minimum of 2.0 mils.
 - .2 The finish shall have a hardness of 2H.
 - .3 The finish shall withstand a minimum salt spray exposure of 1000 hours.
 - .4 The finish shall have an impact resistance of 80 in-lb.

2.2 MANUFACTURED UNITS

- .1 Grilles, registers, and diffusers of same generic type; products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

- .1 Double deflection type: adjustable horizontal face bars and vertical rear bars. Bars spaced 19mm apart. Frame to be gasketed.

- .1 Registers larger than listed sizes: Shop fabricated in sections to appear as one integral register when installed.
- .2 Integral volume control damper: Opposed blade type, constructed of cold rolled steel, coated or galvanized; operable from register face.
- .2 Linear extruded aluminum: blades mechanically locked into heavy extruded aluminum border.
 - .1 Grilles: Fixed (15 degree) blades, spaced 13 mm on center.
 - .2 Border: Precise factory mitered corners.
 - .3 Blades to run parallel to long dimension of grille.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 Louvered grille: horizontal fixed bars set at approximately 45°. Bars spaced 19mm apart.
 - .1 Registers larger than listed sizes: Shop fabricated in sections to appear as one integral register when installed.
 - .2 Integral volume control damper: Opposed blade type, constructed of cold rolled steel, coated or galvanized; operable from register face.
- .2 Egg crate type: aluminum construction. 12 mm (1/2 inch) deep, formed of 12 mm (1/2 inch) wide aluminum strips on 12 mm (1/2 inch) centers. Strips approximately 0.64 mm (0.025 inch) thick to be on 45° angle to reduce visibility into ceiling space. Enclose grilles in channel frame for inverted T-bar mounting or with flanged frame for plaster or gypsum ceiling mounting.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Refer to Architectural drawings and reflected ceiling plans for actual locations of diffusers, grilles, and registers, and install to suit. Mechanical drawings show intent and number of diffusers, grilles and registers required.
- .3 For exposed ductwork installations, connections to grilles to be oversized, with in-turned flanges to meet flange of grilles and duct. Out-turned or exposed flanges with screw mounting are not acceptable.
- .4 Louvered wall grilles to be mounted so louvers are angled to obstruct sightlines into the duct/plenum.
- .5 For special mounting of diffusers, grilles, and registers, refer to Architectural Drawings.

- .6 Where rigid duct is connected to diffuser, grille or register, devices used for flow pattern adjustment, flow balancing and flow equalizing to be accessible from face of diffuser.
- .7 Install mounting frame tied into plaster and gypsum board ceilings to allow lay-in type diffusers to rest on frame.
- .8 Diffusers for installation in lay-in ceiling to lay on inverted T-bars. Spacing as per Architectural Drawings.
- .9 Mount concealed flange linear diffusers in heated environment and following manufacturers' instructions.
- .10 Caulk around edges of linear diffusers in installations with imperfect walls.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials 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 National Fire Protection Association (NFPA)
 - .1 NFPA 96-2014, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2020 (NBC).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .5 Society of Automotive Engineers (SAE)

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.

1.3 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.

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 WEATHER HOODS & GOOSENECKS

- .1 Thickness: to SMACNA
- .2 Fabrication: to SMACNA
- .3 Supports: as indicated.
- .4 Integral birdscreen of 2.7 mm diameter aluminum or stainless steel wire. 12 mm mesh to prevent penetration by 13mm probe.
- .5 Backdraft damper per 23 33 15 – Dampers – Operating at all exhaust openings without a motorized damper and as indicated.
- .6 Weather hoods to be non-flexing heavy gauge metal with sloped top and have a downward snorkel spaced away from wall face. Opening must be level and not sloped
- .7 Finish: factory applied enamel. Colour to be selected from manufacturers list of standard colors at shop drawing phase.

Part 3 Execution

3.1 INSTALLATION

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Anchor securely into opening. Seal with caulking to ensure weather tightness.
- .3 Openings for Weather hood & gooseneck intakes to be minimum 0.5m above the adjacent roof or grade level.

3.2 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 84-2013, Method of Testing Air-to-Air Heat/Energy Exchangers.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for energy recovery equipment; include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Test Reports:
 - .1 Catalogued or published ratings, obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
 - .2 Provide confirmation of testing.
- .4 Manufacturers' Instructions: Submit manufacturer's installation instructions.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .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.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 ENERGY RECOVERY VENTILATOR

- .1 Capacity: refer to schedule on drawings
- .2 Casing: 20-gauge pre-painted galvanized steel interior and exterior panels, access doors with quarter turn handles, 25 mm insulation between panels.
- .3 Supply and exhaust air blowers: Forward curved, permanently sealed and lubricated bearings, Power transmission by adjustable pulleys and belts.
- .4 Motors: Electronically communicated motor.
- .5 Filters: MERV 6 on Fresh air and Exhaust air streams.
- .6 Recovery core: Cross-flow energy recovery core,
- .7 Control: Refer to spec section 23 09 33 Electric and Electronic Control System for HVAC

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations.
- .2 Support independently of adjacent ductwork with flexible connections.
- .3 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers

3.2 FIELD QUALITY CONTROL

- .1 Tests: Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Air-Conditioning, Heating and Refrigeration Institute (AHRI)
 - .1 ANSI/AHRI 210/240-2008, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - .2 AHRI 270-2015, Sound Performance Rating of Outdoor Unitary Equipment.
- .2 CSA Group
 - .1 CSA B52:18, Mechanical Refrigeration Code.
 - .2 CSA C22.1-18, Canadian Electrical Code, Part I (24th edition), Safety Standard for Electrical Installations.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and datasheets; include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Major components and accessories including sound power levels of units.
 - .2 Type of refrigerant used.

1.3 CLOSEOUT SUBMITTALS

- .1 Closeout Submittals: Provide operation and maintenance data for incorporation into O&M manual specified in Section 01 78 00 - Closeout Submittals.

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 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 from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

- .1 Split System Air Conditioner Units:
 - .1 Factory assembled, wired and piped.
 - .2 Factory tested prior to shipping.
- .2 Cooling only unit.

2.2 REFRIGERANT CHARGE

- .1 Refrigerant: R-410A.
- .2 Charge refrigerant system at factory, seal and test.
- .3 Holding charge of refrigerant applied at factory.

2.3 INDOOR UNITS (HP-1 -7)

- .1 Performance: As scheduled.
- .2 Construction:
 - .1 The unit shall be space saving, ceiling-concealed, ducted.
 - .2 The cabinet shall be constructed of insulated galvanized steel.
- .3 Fans:
 - .1 The indoor unit fan assembly shall be two or three (dependent on capacity) fans direct driven by a single motor.
 - .2 The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
 - .3 The indoor fan shall consist of three (3) speeds, Low, Mid, and High. Auto fan speed setting is available.
 - .4 The indoor unit shall have a ducted air outlet and ducted return air system (field provided).
 - .5 The fan speed shall be adjustable by optional remote controller or manufacturer provided service software according to external static pressure.
- .4 Filters:
 - .1 Deep-pleated, 102 mm (4 inch) filters with MERV 8 rating.
- .5 Coil:
 - .1 The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
 - .2 The tubing shall have inner grooves for high efficiency heat exchange.
 - .3 All tube joints shall be brazed with phos-copper or silver alloy.

- .4 The coils shall be pressure tested at the factory.
- .5 A condensate pan and drain shall be provided under the coil.
- .6 The condensate shall be gravity drained from the fan coil.
- .7 The coil fins are coated with hydrophilic paint.
- .8 Both refrigerant lines to the ceiling-concealed ducted indoor units shall be insulated.
- .6 Controls:
 - .1 The indoor unit shall have the capability to be controlled via local wired controllers
 - .2 The indoor unit shall be able to send an on/off signal to its associated duct heater. Provide accessories as required to meet the required sequence of operation. Refer to spec section 23 09 33 Electric and Electronic Control System for HVAC

2.4 OUTDOOR UNITS (CU 1-7)

- .1 Refrigerant Pump: Refrigerant pumps to circulate refrigerant during cold outdoor temperatures in lieu of operating compressors. Include variable-speed drive on refrigerant pump to enable adjustments in response to load.
- .2 Condenser:
 - .1 Performance:
 - .1 Heating operation range: 24°C to -25°C
 - .2 Cooling operation range: -5°C to 49°C
 - .3 Refer to schedules on drawings for individual unit capacities.
 - .2 Construction:
 - .1 The chassis shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.
 - .3 Coil:
 - .1 The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
 - .2 The coil shall be protected with an integral metal guard.
 - .4 Fans:
 - .1 The outdoor unit shall be furnished with axial fan(s) with motor(s).
 - .2 All fan motors shall have inherent protection, thermal protection, and have permanently lubricated bearings, and be completely variable speed.
 - .3 All fan motors shall be mounted for quiet operation.
 - .4 All fans shall be provided with a raised guard to prevent contact with moving parts.
 - .5 The outdoor unit shall have horizontal discharge airflow.
- .5 Compressor

- .1 The compressor shall be an inverter driven, DC voltage, twin BLDC rotary compressor.
- .2 A crankcase heating device shall be factory mounted in/on the compressor.
- .3 The heat pump outdoor unit compressor shall have a soft-start function to reduce electricity demand during system start and to increase compressor reliability.
- .4 The compressor will be equipped with an internal thermal overload.
- .5 The compressor shall be mounted to avoid the transmission of vibration.
- .6 Refrigerant Piping
 - .1 Both refrigerant lines from the outdoor unit to indoor unit shall be insulated.
 - .2 Installed refrigerant pipe length and vertical separation shall be within the published manufacturer's specifications.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Verify that conditions are acceptable for air conditioning components installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.3 INSTALLATION

- .1 Install air conditioner in accordance with manufacturer's instructions and regulations of authorities having jurisdiction.
 - .1 Set air conditioner.
 - .2 Connect refrigerant lines.
 - .3 Make electrical connections.
- .2 Run drain line from cooling coil condensate drain pan to terminate over nearest drain box. Do not run condensate drain line on top of the floor.

- .3 Install refrigerant lines following recommendations of the unit manufacturer.
- .4 Connect softened water to humidifier.

3.4 MANUFACTURER'S START UP AND COMMISSIONING

- .1 Manufacturer's factory-trained representative to attend site for start up and commissioning.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.155-M1986(R2022), Electric Duct Heaters.

1.2 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 duct heaters and controls; include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings showing:
 - .1 Element support details.
 - .2 Unit support.
 - .3 Internal components wiring diagrams.
 - .2 Submit duct heater schedule indicating quantities, sizes, mounting arrangement and 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 airflow.
 - .8 Accessories included.

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 OPEN COIL DUCT HEATERS

- .1 Duct heaters: to CSA C22.2 No.155, and listed for zero clearance to combustible material.

- .2 Design/Performance Criteria:
 - .1 Refer to duct heater schedule for size, electrical requirements (volts, phases), capacity (kW), operating airflow, controller type, number of stages and special accessories.
 - .2 Heater Element Watt/Density: maximum 242 W/mm².
 - .1 Provide derated coils with low-watt density and low airflow controls when faced velocities are lower than 2.0 m/s or duct heaters are used in variable-air-volume applications.
 - .3 Heater Rated Load: provide built-in load fuses for duct heaters with rated load exceeding 48 Amps.
 - .4 Modular Construction: when duct heater modules are assembled on site for large applications, design and construct assembly to operate as a single heater.
 - .5 Disconnect Switch: provide main disconnect for each duct heater assembly.
- .3 Construction:
 - .1 Frame: corrosion-resistant galvanized steel.
 - .2 Heating elements: helical coils of high grade nickel-chrome alloy resistance wire supported and insulated by floating ceramic bushings fastened to frame and supporting brackets.
 - .3 Coil terminal pins: mechanically secured and insulated from frame with high temperature ceramic bushings.
 - .4 Mounting: flanged
- .4 Safety Controls:
 - .1 High Temperature Cut-outs: include fail-safe thermal protection devices which automatically de-energize heater on overheating condition.
 - .1 Primary High Limit Switch: automatic reset disc type thermal cut-out.
 - .2 Secondary High-Limit Switch: additional manual reset disc type thermal cut-out for duct heaters of 30 kW and less.
 - .2 Airflow Proving Switch: diaphragm type air pressure switch with automatic reset, screw type setpoint adjustment and static pressure probe; switch to de-energize duct heater circuits in case of insufficient air flow.
- .5 Panel:
 - .1 Factory mounted NEMA 1 enclosure with terminal blocks for single point power connections and connections of wiring to thermostat, airflow proving switch and/or external controls.
 - .2 Built-in controls and electrical components: factory mounted and wired inside panel; terminate wiring on clearly identified terminal blocks.
 - .3 Provide unit specific wiring diagram permanently attached inside of panel.
- .6 Controls:

- .1 Duct heater to include following built-in controls: magnetic contactors, control transformer, safety controls and controllers.
 - .1 Proportional Control: single-stage proportional control providing full modulation of heater's capacity.
 - .1 Silicon Controlled Rectifier (SCR) or Solid State Relay (SSR) controller with integrated heatsink.
 - .2 Control Input: 0-10 VDC, 4-20 mA.
 - .2 Stage Control: on-off control of a single or multiple stages.
 - .1 Staged heaters: balanced line current at each stage.
 - .2 Each stage to provide uniform face distribution.

2.2 ACCESSORIES

- .1 Provide accessories where listed on duct heater schedule.
- .2 Pilot Lights: factory mounted and wired on heater panel showing staging, power supply status, overheating condition, no airflow, heating status.
- .3 Thermostats: low voltage electronic thermostat compatible with duct heater controller.
 - .1 Room Thermostats: ventilated casing with adjustable setpoint.
 - .2 Duct Thermostats: insertion type with casing and adjustable setpoint.

Part 3 Execution

3.1 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.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 01 91 13 - General Commissioning Requirements and Section 26 05 00 - Common Work Results for Electrical.

- .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 Field 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.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.46-13, Electric Air-Heaters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA 250-14, Enclosures for Electrical Equipment (1000 V Maximum).

1.2 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 unit heaters and include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

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 unit heaters for incorporation into O&M manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 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 unit heaters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SURFACE MOUNTED FORCE FLOW HEATER

- .1 Construction
 - .1 18-gauge steel front cover.
 - .2 Bottom air outlet.
 - .3 High-limit temperature control with automatic reset
- .2 Fan
 - .1 Closed, factory-lubricated motor.
 - .2 Fan delay purges heater of residual heat.
- .3 Heating element
 - .1 Tubular heating element with fins
- .4 Control
 - .1 Built in thermostat
- .5 Finish: epoxy powder coat
- .6 Color: manufacturers standard off-white

Part 3 Execution

3.1 INSTALLATION

- .1 Install heaters on ceiling or mount on wall as indicated.
- .2 Install thermostats in locations indicated.
- .3 Make power and control connections.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Test cut-out protection when air movement is obstructed.
- .3 Test fan delay switch to assure dissipation of heat after element shutdown.
- .4 Test unit cut-off when fan motor overload protection has operated.
- .5 Ensure heaters and controls operate correctly.

3.3 PROTECTION

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

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section includes:
 - .1 Labour, products, equipment and services necessary to complete the work of this Section.
 - .2 The requirements of this section apply to the work of all Division 26, 27 and 28 sections.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1-21 Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installation.
 - .2 CAN3-C235-19, Preferred Voltage Levels for AC Systems, 0 to 50,000V.
 - .3 CSA B651-18 – Accessible Design for the Built Environment.
 - .4 CSA Z462-21 – Workplace Electrical Safety.
- .2 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.
- .3 GB Initiative Canada
 - .1 GREEN GLOBES Canada Design for New Construction and Major Retrofits v.2, <http://www.greenglobes.com>

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 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 review and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 Submittal Procedures.

- .4 Submit for review single line electrical diagrams and locate in main electrical room.
- .5 Submit for review fire alarm riser diagram, plan and zoning of building at fire alarm control panel and annunciator.
- .6 Submit to the local Electrical Safety Authority the necessary number of electrical drawings and specifications for examination, special inspection and/or approval, prior to the commencement of the work, and pay for all costs and associated fees. If required prepare any additional drawings/documents required by either Authority.
- .7 Obtain and pay for permits and inspections required for the work performed.
- .8 Engineered Shop drawings:
 - .1 Provide and submit short circuit co-ordination study and arc flash study for review by DCC Representative. The study shall be 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 Submit one electronic copy of reviewed shop drawings to DCC Representative for information.
 - .6 If changes are required, notify DCC Representative of these changes before they are made.
- .9 Certificates:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material are 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 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.
- .10 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.

- .11 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.

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 review 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 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect 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 Construction Waste

Management Plan in accordance with Section 01 74 19 Waste Management and Disposal.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Adhere to the requirements of the Construction Waste Management plan as per Section 01 74 19 Waste Management and Disposal.
- .2 Remove from site and dispose of all 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.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by DCC Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Place materials defined as hazardous or toxic waste in designated containers.
- .7 Ensure emptied containers are sealed and stored safely for disposal.
- .8 Separate for reuse and recycling and place in designated containers steel, metal and plastic waste in accordance with the Waste Management Plan.
- .9 Handle and dispose of hazardous materials in accordance with CEPA, Regional and Municipal regulations.
- .10 Remove for reuse and return of pallets, crates, padding and packaging materials as per the Construction Waste Management Plan.
- .11 Unused and/or redundant batteries must be disposed off at an official hazardous material collections site as approved by the DCC Representative.
- .12 Collect, package and store redundant motors for either recycling or rebuilding and return to recycler or rebuilder.

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 both languages.

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 are 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 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Refer to mechanical contract documents for information related to mechanical controls and control wiring including responsibility for supply and installation.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction, inspection authorities and DCC Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 SPRINKLER PROOF EQUIPMENT

- .1 Ensure that electrical equipment installed in electrical rooms and other areas containing sprinklers is constructed such that exposure to water from the sprinkler heads does not impair the effectiveness of the enclosed equipment.
- .2 Where penetrations are made in drip shields, flash and seal using manufacturer's approved caulking to maintain drip shield integrity.
- .3 Ensure that enclosure louvres are of outdoor design such that falling water or water running down the sides will not enter the enclosure.
- .4 Where enclosure openings in the top or sides are required for outgoing conduits, provide waterproof conduit fittings.
- .5 Provide panels with hoods.
- .6 In electrical rooms containing sprinklers provide wall mounted equipment such as pull boxes, junction boxes, splitter troughs, wireways, auxiliary gutters, cable troughs and disconnect switches located below the level of the sprinkler heads with the following accessories:
- .7 Gaskets on doors and drip shields on equipment, panelboards, panels and enclosures.
- .8 Louvres facing outward and downward where openings are required for heat dissipation. Expanded metal screening is not acceptable.

2.7 HOUSEKEEPING PADS

- .1 Provide 100 mm high concrete pads under floor mounted electrical equipment. Extend pads 50 mm outside the equipment perimeter.

2.8 FIRE BARRIERS

- .1 Where electrical material or devices pass through fire rated separations, make penetrations and provide fire barrier seals with a fire resistance rating equivalent to the rating of the separation.
- .2 Prior to installation, submit for review, proposed fire barrier seal materials, method of installation and ULC system number.
- .3 For fire rated feeders, provide ULC listed fire stopping at the ends of conduits in panels and boxes.

2.9 MISCELLANEOUS METAL FABRICATIONS

- .1 Provide miscellaneous structural supports, platforms, braces, brackets and preformed channel struts necessary for suspension, attachment or support of electrical equipment in accordance with Section 05 50 00 Metal Fabrications.

2.10 DND EQUIPMENT

- .1 Prior to ordering any equipment, confirm the details, specifications and installation requirements for all DND supplied equipment requiring electrical connections. The DCC Representative shall supply technical information including electrical ratings and installation details. The coordination of electrical provisions for this equipment is included in this contract and no electrical equipment shall be ordered without written confirmation from the DCC Representative. No allowance shall be made for failure to complete this coordination work, thereby resulting in an incorrect installation.

2.11 EQUIPMENT SUPPLIED BY OTHER DIVISIONS

- .1 Obtain electrical ratings, specifications, installation requirements and approved shop drawings of all equipment requiring electrical connections that is supplied by other divisions. No electrical equipment shall be ordered prior to obtaining this information. No electrical equipment shall be ordered prior to a formal review and acceptance of this information by the DCC Representative. The DCC Representative shall issue written acceptance of the information and shall also provide, if required, documented changes to the electrical design resulting from the review of this information. No allowance shall be made for failure to complete this coordination work, thereby resulting in an incorrect installation.

2.12 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face with white lettering for normal power system, and red face with white lettering

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for emergency power system. Lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by DCC Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No." as directed by DCC Representative.
- .7 Disconnect switches, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.
- .10 Provide arc flash hazard labels for the electrical equipment with the finding from the arc flash hazard analysis. A standard arc flash hazard label shall include all of the following information.
 - .1 At least one of the following: available incident energy and corresponding working distance, minimum arc rating of clothing, required level of PPE, highest Hazard/Risk Category (HRC) for the equipment
 - .2 Nominal System Voltage
 - .3 Arc flash boundary.
- .11 Identify each receptacle and system furniture box with panel and circuit number on typewritten label.

2.13 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.

- .4 Use colour coded wires in communication cables, matched throughout system.

2.14 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.
- .4 Colour code all existing to remain installation with new.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.15 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC standard.
- .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 HOUSEKEEPING PADS

- .1 Provide concrete pads to the requirements of Section 03 10 00 Concrete Forming and Accessories.

3.4 FIRE BARRIERS

- .1 Provide fire stopping to the requirements of Section 07 84 00 Firestopping.

3.5 CORE DRILLING

- .1 Provide core drilling to the requirements of Section 01 73 00 Execution.

3.6 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.7 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.8 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: 1100 mm.
 - .2 Wall outlets power and communication, general: 450 mm.
 - .3 Mechanical Rooms outlets: 1100 mm
 - .4 Fire alarm pull stations: 1100 mm

- .5 Wall mounted speakers or strobes: 2300 mm or 150 mm below ceiling
- .6 Card readers: 900 mm as general.
- .7 Door operators: 900 mm
- .8 Panelboards: as required by OESC and/or as indicated.
- .9 Intercoms and wall-mounted phone: 1100 mm AFF as general.
Coordinate with DCC Representative prior to rough-in.
- .10 Hand Dryers: 580 mm AFF.

3.9 ARC FLASH STUDY

- .1 Conduct and pay for an Arc Flash Study on the normal equipment added through this project to the power distribution system. Statement will confirm all components are fully coordinated.
- .2 Review the site and all relative equipment information as required to collect all information necessary to conduct the study.
- .3 Submit report, sealed by a Professional Engineer, to DCC Representative for review prior to manufacturing.
- .4 Provide Arc Flash warning signs and labels on all equipment as per the results of the study.

3.10 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as determined in the short circuit coordination study.
- .2 Ensure all distribution equipment is labelled in accordance with the Arc Flash Study.
- .3 Provide a signed letter from a Professional Engineer licensed in the Province of Ontario confirming the following:
 - .1 Settings of the protective devices have been adjusted as per the short circuit coordination study.
 - .2 Arc flash classification labels to all items of electrical distribution equipment have been installed as per the Arc-flash study.

3.11 FIELD QUALITY CONTROL

- .1 Carry out testing for electrical systems and equipment in accordance with relevant standards such as CSA, ULC, ANSI. Comply with the Acceptance Testing Specifications for the International Electrical Testing Association Inc (NETA).
- .2 Conduct and pay for all testing.
- .3 Refer to each Section of Division 26, 27 and 28 for additional testing requirements for specific equipment components.

- .4 Provide the instruments, meters, equipment and personnel required to conduct the tests during and at the conclusion of the project.
- .5 Utilize and follow procedures for testing as outlined in the NETA 2001 standard for acceptance testing and in addition as described in various electrical sections.
- .6 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.
- .7 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 and communications.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .8 Carry out tests in presence of DCC Representative.
- .9 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.12 INTEGRATED LIFE SAFETY SYSTEMS TEST

- .1 At the completion of construction but prior to deeming the contract substantially complete, the contractor shall carry out an Integrated Life Safety Systems Test in accordance with The National Building Code and CAN/ULC-S1001. This test shall include the following:
 - .1 Demonstrate that all life safety system ancillary functions that are initiated by the fire alarm system operate as specified. Functions may include

integration with Suppression Systems, Mechanical HVAC Systems, Smoke Dampers and Door Hardware.

- .2 Demonstrate the continued operation of all the functions noted above while the building power supply has been turned off.
- .3 Demonstrate the continued operation of all the functions noted above during the restoration of the building power supply.
- .2 The Integrated Life Safety Systems Coordinating Consultant shall prepare a detailed Test Procedure prior to the test. Arrange for all necessary trades and equipment suppliers/installers required to carry out the test be present and assist in the test.
- .3 Compile all required shop drawings and installation certifications for each of the integrated life safety systems and submit to the Integrated Life Safety Systems Coordinating Consultant.
- .4 Confirm acceptable test results in accordance with the prepared Test Procedure before formal witnessing of the test by the Coordinating Consultant occurs.

3.13 SYSTEM STARTUP

- .1 Instruct DCC Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of factory service engineer for major systems, 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.

3.14 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:
 - .4 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .5 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .6 Safety precautions.
 - .7 Procedures to be followed in event of equipment failure.
 - .8 Other items of instruction as recommended by manufacturer of each system or item of equipment.

3.15 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 Cleaning.
- .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 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 21 – Wires and Cables (0-1000 V).

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA-C22.2 NO. 239-M91. Control and instrumentation cables.
 - .2 CAN/CSA-C22.2 No.65-18, Wire Connectors (Tri-National Standard with UL 486A-486B and NMJ-J-543-ANCE-).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .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.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, TECK cable, mineral insulated cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 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.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 20 – Wire and Box Connectors (0-1000 V)
- .3 Section 26 05 22 – Connectors and Terminations
- .4 Section 26 05 34 – Conduits – Conduit Fastenings and Conduit Fittings
- .5 Section 28 31 00.01 – Multiplex Fire Alarm System

1.2 REFERENCE STANDARDS

- .1 CAN/CSA-C22.2 NO. 239-M91. Control and instrumentation cables.
- .2 CSA C22.2 No. 38-18, Thermoset Insulated Wires and Cables (Trinational standard with UL 44 and ANCE NMX-J-451).
- .3 CSA C22.2 No. 49-18, Flexible Cords and Cables (Trinational standard with UL 62 and NMX-J-436-ANCE-2018).
- .4 CAN/CSA C22.2 No. 51-20, Armoured Cables
- .5 CSA C22.2 No. 75-17, Thermoplastic Insulated Wires and Cables (Trinational standard with UL 83 and NMX-J-010-ANCE-2017).
- .6 CSA C22.2 No. 124-16 (R2021), Mineral-Insulated Cables
- .7 CSA C22.2 No. 127-18, Equipment and Lead Wires
- .8 CAN/CSA-C22.2 No. 131-17, Type Teck 90 Cable
- .9 CSA C22.2 No. 208-18, Fire Alarm and Signal Cable
- .10 Underwriters Laboratories of Canada (ULC).
 - .1 ULC FHITC.1850, Electrical Circuit Integrity Systems, System No. 1850 – listed on ULC certifications directory on December 21, 2012.

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Section 26 05 00 Common Work Results for Electrical.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

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 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE or RWU90 XLPE, Non Jacketted.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon rated at 600 V.

2.2 TECK 90 CABLE

- .1 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .2 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 600 V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: interlocking galvanized steel.
- .5 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .6 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 300 mm centers.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .7 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

- .1 Conductors: solid bare soft-annealed copper, size as indicated.
- .2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.
- .3 Outer covering: annealed seamless copper sheath, Type MI rated 600 V, 250 degrees C.
- .4 Two-hour fire rating.
- .5 Connectors: watertight, field installed approved for MI cable.
- .6 Termination kits: field installed approved for MI cable.

- .7 ULC listed: tested to CAN/ULC-S139 fire test standards.

2.4 ARMoured CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: anti short connectors.

2.5 CONTROL CABLES

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath: cotton braid thermoplastic jacket, and armour of closely wound aluminum wire.
- .2 Type: low energy 300 V control cable: solid stranded annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: PVC
 - .2 Shielding: wire braid over conductors.
 - .3 Overall covering: PVC jackets.

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.
- .4 Test all power feeder cables to the following equipment:
 - .1 Service Entrance Breaker
 - .2 Service Entrance Board
 - .3 Panelboards
- .5 Megger test insulation resistance phase to phase and phase to ground.
- .6 Test feeder cables prior to termination with cable ends separated 50 mm distance. Minimum acceptable reading, 100 megohms.
- .7 Megger test feeder cables after termination. Minimum acceptable reading 100 megohms.
- .8 Megger test each feeder cable with switch or breaker open.

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. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0-1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps or hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

- .1 Install cable exposed, securely supported by straps and hangers.
- .2 Support 2-hour fire rated cables at 1 m intervals.
- .3 Make cable terminations by using factory-made kits.
- .4 Cable terminations: use thermoplastic sleeving over bare conductors.
- .5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.
- .6 Do not splice cables unless indicated.

3.6 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.
- .2 Cable length limitation from ceiling box to luminaire:
 - .1 1.2 m in non-accessible ceilings
 - .2 1.8 m in accessible ceilings

3.7 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 20 – Wire and Box Connectors 0-1000 V.
- .3 Section 26 05 21 – Wires and Cables (0-1000 V).

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.41-13 (R2017), Grounding and Bonding Equipment (Tri-National Standard, with NMJ-J-590ANCE and UL 467).
 - .3 CSA C22.2 No.65-18, Wire connectors (Tri-National Standard, with UL 486A-486B NMJ-J-543-ANCE).

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.
- .2 Twist type splicing connectors, copper, sized to suit, with nylon or plastic shroud for tee connections in #10 AWG and smaller conductors.
- .3 Connection kits for low voltage motors.
- .4 Connectors for Type AC90 Cable
 - .1 Steel or malleable iron
 - .2 Insulated throat
- .5 Connectors for Type TECK90 Cable
 - .1 Copper free aluminum body
 - .2 Steel or copper free aluminum fittings and locknut.

Part 3 Execution

3.1 INSTALLATION

- .1 Install terminations and splices in accordance with manufacturer's instructions.
- .2 Make splices in junction boxes.
- .3 Make connections in lighting circuits with twist type splicing connectors.
- .4 Terminate and splice conductors No. 8 and larger at terminal blocks in junction boxes.
- .5 Seal terminations and splices exposed to moisture, corrosive conditions or mechanical abrasions with heavy wall heat shrinkable insulation.
- .6 Install fixture type connectors and tighten. Replace insulating cap.
- .7 Install motor lead connection kits for low voltage motors.
- .8 Bond and ground as required to CSA C22.2No.41.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-14, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .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 26 05 00 Common Work Results for Electrical.
- .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 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.
- .3 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.
- .4 Plate electrodes: copper, surface area 0.2 m², minimum 1.6 mm thick.

- .5 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green, copper conductors, size as indicated.
- .7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, raceways, cable trays, accessories. Where EMT and non-metallic raceways are used, run insulated ground conductor in raceway.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Install grounding jumpers across building expansion joints.
- .12 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

- .13 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .14 Ground secondary service pedestals.

3.2 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water metre shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod, plate electrodes and make grounding connections as indicated.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 4/0 AWG copper conductors for connections to electrodes.
- .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 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 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.5 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.6 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.
- .5 Prepare and submit 3 copies of Test Report, signed by the Test Engineer, and where witnessed, by DCC Representative. Include record of tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number. Calibration record shall include percentage error, correction factors, if any.

3.7 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .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.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps:
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems:
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 2 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of DCC Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1-21 Canadian Electrical Code, Part 1 25th Edition, Safety Standard for Electrical Installation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

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: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three (3) spare terminals or lugs on each connection or lug block sized less than 400 A.

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 turned edge covers.

2.3 CABINETS

- .1 Construction: welded sheet steel hinged door, handle, latch lock 2 keys and catch.

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.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

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 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1-21 Canadian Electrical Code, Part 1 25th Edition, Safety Standard for Electrical Installation.
 - .2 CSA-C22.2 No.18.2-(R016), Non-metallic Outlet Boxes.
 - .3 CAN/CSA-C22.2No.18.1-13(R2018), Metallic Outlet Boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

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 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster and tile walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CAN/CSA C22.2 No. 18.3-12 (R2017), Conduit, Tubing and Cable Fittings (Tri-National Standard, with ANCE NMX-J-017 and UL 514B).
 - .2 CSA C22.2 No. 45.1-07 (R2017), Electrical Rigid Metal Conduit, Steel (Tri-National Standard with UL6 and NMX-J-534-ANCE-2007)
 - .3 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2017), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-06, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-21, Mechanical Protection Tubing (MPT) and fittings, (Trinational standard with UL 1696 and NMX-J-855-ANCE).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical.
- .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.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One-hole malleable iron 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 2 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 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use rigid galvanized steel threaded conduit on exterior of buildings, where exposed to mechanical damage, within all concrete construction where conduits turn up out of a concrete slab.
- .4 Use electrical metallic tubing (EMT) concealed in walls.
- .5 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
- .6 Use rigid PVC conduit underground.
- .7 Use liquid tight flexible metal conduit for connection to motors, transformers and vibrating equipment.
- .8 Minimum conduit size for lighting and power circuits: 21 mm.
- .9 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints with heavy coat of bituminous paint.

3.8 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA-Z809-08, Sustainable Forest Management.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cables 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 in accordance with Section 26 05 00 - Common Work Results for Electrical.

Part 2 Products

2.1 CABLE PROTECTION

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

2.2 MARKERS

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

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
 - .1 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 DIRECT BURIAL OF CABLES

- .1 After sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable.
 - .1 Do not pull cable into trench.
- .2 Include offsets for thermal action and minor earth movements.
 - .1 Offset cables 150 mm minimum for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 0.6 m minimum of surplus cable in each direction.
 - .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written

recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.6 Cable separation:

- .1 Maintain 75 mm minimum separation between cables of different circuits.
- .2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.
- .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
- .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
- .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
- .6 Install treated planks on lower cables 0.6 m minimum in each direction at crossings.

- .7 After sand protective cover is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks interlocking cable blocks as indicated to cover length of run.

3.3 CABLE INSTALLATION IN DUCTS

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

3.4 MARKERS

- .1 Mark cable every 150 m along cable duct runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Install concrete cable markers within 180 m from each side of runway centreline; 45 m from each side of taxi way centreline; 50 m from edge of taxi ramps or aprons.

- .5 Install cedar post type markers.
- .6 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests:
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at of original factory test voltage in accordance with manufacturer's recommendations.
 - .4 Leakage Current Testing:
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.
 - .3 Record leakage current at each step.
- .7 Provide DCC Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace the entire length of cable if cable fails to meet any of test criteria.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 26 05 00 Common Work Results for Electrical.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 05 00 Common Work Results for Electrical
- .3 Waste Management in accordance with Section 26 05 00 Common Work Results for Electrical.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data and Shop Drawings:
 - .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.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 VACANCY SENSORS

- .1 Low Voltage Dual Technology wall switch vacancy sensor switch with the following features:
 - .1 15-24VDC; <3mA rated
 - .2 Isolated relay with 1-N/O and N/C outputs rated for 1 amp at 30V DC.
 - .3 Automatic off set at 15 minutes.
 - .4 Integral ON/OFF pushbutton
 - .5 Integral 180° PIR detection
 - .6 40KHz high frequency ultrasound detection
 - .7 Coverage: minor motion 6m, large motion 10m.
 - .8 Adjustable time delays for each detection mode.
 - .9 White finished.
 - .10 Flush mounted in decorator style wall plate.

2.2 PHOTOCCELL

- .1 Exterior Photocell:
 - .1 Twist lock type, high impact ABS plastic
 - .2 Minimum rating 1800VA
 - .3 120/277/347V operation
 - .4 Minimum 200 joule surge rating
 - .5 Rated for 5000 operations
 - .6 Silicon type photosensor
 - .7 Fail to On

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.
- .2 Actuate control units in presence of DCC Representative to demonstrate lighting circuits are controlled as designated.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

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 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 28 – Grounding – Secondary
- .3 Section 26 28 16.02 – Moulded Case Circuit Breakers

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.31-18, Switchgear Assemblies

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for service entrance board and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Floor anchoring method and foundation template.
 - .2 Dimensioned cable entry and exit locations.
 - .3 Dimensioned position and size of bus.
 - .4 Overall length, height and depth.
 - .5 Dimensioned layout of internal and front panel mounted components.
 - .2 Include time-current characteristic curves for circuit breakers.
- .4 Test and Evaluation Reports:
 - .1 Submit 4 copies of certified test results.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit maintenance materials in accordance with Section 26 05 00 Common Work Results for Electrical.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.

- .2 Operation and Maintenance Data: submit operation and maintenance data for service entrance board for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

- .1 Service Entrance Board: to CSA C22.2 No.31.
- .2 Rating: 120/208 V, 3-phase, 4 wire, 600 A, short circuit current 50 kA (rms symmetrical).
- .3 Cubicles: free standing, dead front, size as indicated.
- .4 Barrier metering section from adjoining sections.
- .5 Provision for installation of power supply authority metering in barriered section.
- .6 Owner's metering.
- .7 Distribution section.
- .8 Hinged access panels with captive knurled thumb screws.
- .9 Bus bars and main connections: 99.3% copper.
- .10 Bus from load terminals of main breaker via metering section to main lugs of distribution section.
- .11 Identify phases with colour coding.

2.2 MAIN BREAKER

- .1 Molded case circuit breakers, 3 pole, quick make, quick break, trip free, thermal magnetic trip elements, size as shown on the drawings.

2.3 DISTRIBUTION BREAKERS

- .1 Molded case circuit breakers, 3 pole, quick make, quick break, trip free, thermal magnetic trip elements, size as shown on the drawings.

2.4 METER STACK

- .1 Meter socket module shall include a barrier in the meter socket to ensure tenant main breaker and wire way section are physically separated.
- .2 Meter stacks to be complete with sealing screw kit for sealing provisions on two (2) corners of tap box, vent covers, module covers and cross bus compartments. Any exposed side, back, front or top cover that would provide access to an unmetered bus shall require provision for sealing via a rotary seal.
- .3 Configuration shall include hot sequenced metering.

- .4 Refer to drawings for number of meter stacks and size of meters in each stack.

2.5 GROUNDING

- .1 Copper ground bus extending full width of cubicles and located at bottom.
- .2 Lugs at each end for grounding cable.

2.6 POWER SUPPLY AUTHORITY METERING

- .1 Separate compartment and metal raceway for exclusive use of power supply authority metering.
- .2 Mounting accessories and wiring for metering supplied by power supply authority:
 - .1 3 potential transformers.
 - .2 3 current transformers.
 - .3 Watthour meter.
 - .4 Demand meter with kWh register.

2.7 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00 Common Work Results for Electrical.
 - .1 Service entrance board exterior: gray.

2.8 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Nameplates:
 - .1 White plate, black letters, size 7.
 - .2 White plate, black letters, size 7.
 - .3 Complete board labelled: "120/208V."
 - .4 Main disconnect labelled: "Main Breaker".
 - .5 Branch disconnects labelled: "Feeder No. 1", "Feeder No. 2", "Feeder No. 3", as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate service entrance board.
- .2 Connect main secondary service to line terminals of main breaker.
- .3 Connect load terminals of distribution breaker's to feeders.
- .4 Check factory made connections for mechanical security and electrical continuity.

- .5 Run one grounding conductor 4/0 AWG bare copper in 25 mm conduit from ground bus to building ground.
- .6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 28 16.02 – Moulded Case Circuit Breakers

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.29-15 (R2019), Panelboards and Enclosed Panelboards.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Include on drawings electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

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 Bus and breakers rating for symmetrical interrupting capacity as indicated on schedules and single line diagrams.
- .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 on drawings.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains, unless shown otherwise.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: baked grey enamel.

2.2 LOAD CENTRES

- .1 Install load centres in individual residential suites only. All other panel boards, not located within a suite, shall be bolt-on breaker type as specified:
 - .1 Load Centres shall be the product of one manufacturer.
 - .2 Install circuit breakers in load centre before shipment.
- .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .3 250V load centres: bus and breakers rated for 10 KA (symmetrical) interrupting capacity minimum or as indicated.
- .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .5 Mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .6 Tin plated aluminium bus.
- .7 Neutral bar of same ampere rating as mains.
- .8 Mains: suitable for push-on type breakers.
- .9 Door with concealed hinges and spring loaded, front operable latch mechanism.
- .10 Trim and door finish: White and finished to accept field painting.

2.3 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 breakers installed as indicated on drawings.
- .5 Tandem and mini style are not acceptable.

2.4 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.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00 Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits. Connect neutral conductors to common neutral bus with respective neutral identified.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

3.3 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 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.42-10 (R2020), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1-13 (R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55-15 (R2020), Special Use Switches.
 - .4 CSA C22.2 No.111-18, General-Use Snap Switches (Trinational Standard with UL 20 and NMX-J-005-ANCE).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data and Shop Drawings:
 - .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.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 SWITCHES

- .1 15 A, 120 V single pole and three-way, as shown on the drawings, 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 Decorator style, white finished.
- .3 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads and heating loads.
- .4 Switches of one manufacturer throughout project.

2.2 WALL BOX DIMMERS

- .1 Large paddle switch with captive linear slidable dimmer located beside the paddle.
- .2 Shall fit a standard designer wall plate opening.
- .3 Dimmers shall be rated for load, load type, and control protocol as shown on the drawings.
- .4 De-rate dimmer capacity as manufacturer's direction when mounting in multiple gang configurations.
- .5 Install dimmers as per manufacturer's instructions.
- .6 White finished designer style.

2.3 RECEPTACLES

- .1 Commercial grade duplex receptacles, CSA type 5-15R and 5-20R as shown on the drawings, 125 V, 15 A, and 15/20 A, U ground, for installation in public spaces, and with following features:
 - .1 White thermoplastic nylon molded body and face.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight (8) back wired entrances, four (4) side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .6 White rectangular decorator style.
- .2 Commercial grade ground fault circuit interrupter (GFI) duplex receptacles, CSA type 5-15R and 5-20R as shown on the drawings, 125 V, 15 A, and 15/20 A, U-ground, for installation in public spaces, and with following features:
 - .1 White thermoplastic nylon molded body and face.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Eight (8) back wired entrances, four (4) side wiring screws.
 - .4 Silver alloy contacts.
 - .5 Heavy duty double wipe contacts.

- .6 Test and reset button.
- .7 Green LED indicator light.
- .8 White rectangular decorator style.
- .9 AC horsepower rating at rated voltage: 1 ½ HP.
- .10 Temperature rise: max 30 degree C after 50 cycles OL at 150% rated current.
- .11 Current limiting: 10 kA.
- .3 Residential grade duplex receptacles, CSA type 5-15R and 5-20R as shown on the drawings, 125 V, 15 A, and 15/20 A, U ground, with following features:
 - .1 White thermoplastic nylon molded body and face.
 - .2 Suitable for up to No. 10 AWG for back and side wiring.
 - .3 Eight (8) back wired entrances, four (4) side wiring screws.
 - .4 Brass plated ground clips, zinc plated steel strap.
 - .5 Tamper resistant.
 - .6 White rectangular decorator style.
- .4 Residential grade ground fault interrupter (GFI) duplex receptacles, CSA type 5-15R and 5-20R as shown on the drawings, 125 V, 15 A, and 15/20 A, U-ground, with following features:
 - .1 White thermoplastic nylon molded body and face.
 - .2 Suitable for No. 12 AWG for back and side wiring.
 - .3 Red trip indicator light.
 - .4 Side or internal screw pressure plate back wire complete with four (4) side wiring screws.
 - .5 Dual direction test and reset button.
 - .6 Tamper resistant.
 - .7 White rectangular decorator style.
- .5 Single receptacles CSA type 14-30R, 125/250 V, 30 A, 3-pole, 4 wire, U ground, straight blade (dryer receptacle) with following features:
 - .1 1-Piece Construction with integral 5.50"X 5.43" mounting plate, flush mounted Receptacle
 - .2 White finished.
 - .3 Up to No. 4 AWG for back and side wiring.
- .6 Single receptacles CSA type 14-50R, 125/250 V, 50 A, 3-pole, 4 wire, U ground, straight blade (range receptacle) with following features:
 - .1 1-Piece Construction with integral 5.50"X 5.43" mounting plate, flush mounted Receptacle
 - .2 White finished.
 - .3 Up to No. 4 AWG for back and side wiring.

- .7 Suite UTP outlets:
 - .1 To be complete with one (1) Cat 6 outlet and one (1) type F1 connector.
 - .2 Coverplate / faceplate to be white finished.
- .8 Other receptacles with ampacity and voltage as indicated.
- .9 Receptacles of one manufacturer throughout project.

2.4 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 Commercial grade nylon coverplates for devices in public spaces, plate style to match devices.
- .4 Residential grade nylon coverplates for devices in public spaces, plate style to match devices.
- .5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.
- .8 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Unless noted otherwise on the drawings 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.
- .5 Provide separate neutral and separate insulated ground conductors for each dedicated circuit and for each circuit associated with isolated ground receptacles.
- .3 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

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 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.
- .2 Ship fuses in original containers.
- .3 Store fuses in original containers in storage cabinet moisture free location.

1.3 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Six (6) spare fuses of each type and size installed up to and including 600 A.

Part 2 Products

2.1 FUSES - GENERAL

- .1 Fuse type references J1, J2 and R1 have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

- .1 Class J fuses up to 600V, up to and including 600A
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type J2, fast acting.
- .2 Class R fuses 250V and/or 600V up to and including 600A
 - .1 Type R1, time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

2.3 FUSE STORAGE CABINET

- .1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 - Common Work Results for Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
 - .1 Install rejection clips for Class R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.
- .5 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.2 No. 5-16 (R2021), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMJ-J-266-ANCE-2016).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .2 Confirm that the rating of all moulded case circuit breakers are conformed with power distribution system short circuit study.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

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 with interchangeable trips as indicated.
- .6 Circuit breakers to have minimum 10,000 A symmetrical rms interrupting capacity rating. Required rating shown on drawings and panelboard schedules.
- .7 All circuit breakers are 80% rated, unless noted otherwise.

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CAN/CSA C22.2 No.144.1-16 (R2020), Ground Fault Circuit Interrupters (Tri-national standard with UL 943 and NMX-J-520-ANCE).
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PB 2.2-2014, Application Guide for Ground Fault Protection Devices for Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product and Shop Drawings 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 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.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions

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 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single pole ground fault circuit interrupter for 15 A, 120 V, 1 phase circuit complete with test and reset facilities or rating as indicated on drawings.

2.3 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained with 15 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.

Part 3 Execution

3.1 INSTALLATION

- .1 Pass phase conductors including neutral through zero sequence transformers.
- .2 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 28 13.01 – Fuses – Low Voltage.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CAN/CSA-C22.2 No.4-16 (R2020), Enclosed and Dead-Front Switches (Tri-National Standard, with NMX-J-162-ANCE-2016 and UL 98).
 - .2 CSA C22.2 No.39-13 (R2017), Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical
- .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.
- .3 Provide a list of equipment that is fed from the disconnect switch with phase detector.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible and Non-fusible, Horsepower rated disconnect switch in CSA enclosure Type 1 for indoor installation, Type 3R for outdoor installation, CSA enclosure to CAN/CSA-C22.2 No.4 size as indicated.
- .2 Provision for padlocking in on-off switch position by 3 locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.
- .5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.

- .7 ON-OFF switch position indication on switch enclosure cover.
- .8 Electrical Interlock as indicated on the drawings: mechanically operated from switch mechanism, rated 120 V AC, 15A, 1 N/O and 1 N/C contact.

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.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.
- .2 Install local to equipment on adjacent wall, or other suitable mounting surface. Where necessary provide free standing rigid continuous slotted channel strut frame.
- .3 Where mounted on masonry walls, allow minimum of 6 mm clear space between enclosure and masonry wall.
- .4 Install fused disconnect switches with viewing window for all elevator controllers, the disconnect switches are capable of being locked at "Open" position.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 International Electrotechnical Commission (IEC)
 - .1 IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.
 - .2 IEC 60947-4-1 Edition 4.0 10-2018, Part 4-1: Contactors and motor starters – Electromechanical Contactors and Motor-Starters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical.
- .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 Shop Drawings:
 - .1 Provide shop drawings: in accordance with Section 26 05 00 Common Work Results for Electrical. For each type of starter to indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout and components.
 - .4 Enclosure types.
 - .5 Wiring diagram.
 - .6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

1.5 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 transformer.
- .5 1 operating coil.
- .6 2 fuses.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 MATERIALS

- .1 Starters: to IEC 947-4 with AC4 utilization category.

2.2 MANUAL MOTOR STARTERS

- .1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 Overload heater, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Pushbutton: heavy duty labelled as indicated.
 - .2 Indicating light: heavy duty and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 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 Wiring and schematic diagram inside starter enclosure in visible location.
 - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control motor circuit interrupter, and provision for:
 - .1 Locking in "OFF" position with up to 3 padlocks.
 - .2 Independent locking of enclosure door.
 - .3 Provision for preventing switching to "ON" position while enclosure door open.

- .3 Accessories:
 - .1 Selector switches: heavy duty labelled as indicated.
 - .2 Indicating lights: heavy duty type and Colour as indicated.
 - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 Common Work Results for Electrical.

2.6 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 3 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install starters and control devices in accordance with manufacturer's instructions.
- .2 Install and wire, starters and controls as indicated.
- .3 Ensure correct fuses installed.
- .4 Confirm motor nameplate and adjust overload device to suit.

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 on load 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 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05
00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41- 1991, IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 ICES-005-15, Radio Frequency Lighting Devices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical.
- .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 manufacturer's written installation instructions and special handling criteria and installation sequence.
 - .3 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by DCC Representative.
 - .4 Photometric data to include: VCP Table where applicable and spacing criterion.
 - .5 Provide samples for lighting fixtures as indicated. Install sample fixtures in mock-up ceiling. Include cost of mock-up in project price. Locate mock-up on site.
 - .6 Light fixture construction to meet ULC listings and CSA certifications related to intended installation.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit data for lighting fixtures for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 LED LUMINAIRES

- .1 LED fixtures are to be provided by manufacturers with a minimum (8) years' experience and provide minimum (5) years warranty on all electrical parts, paint and mechanical components.
- .2 All luminaires must be tested in accordance with IESNA LM-63 by an independent LM-63 accredited laboratory. LM-63 test data in the form of IES-format electronic files must be available for all luminaires. Software generated/calculated IES files will not be accepted.
- .3 Maximum Efficacy (lm/W) of luminaires must be greater than 60 lm/W for downlights and greater than 90 lm/W for linear/volumetric luminaires, unless noted otherwise.
- .4 All luminaires shall have a CRI ≥ 80 , source LEDs shall be binned per ANSI within a 3-step MacAdam Ellipse.
- .5 Colour changing LED luminaires shall provide full spectrum colour changing capability through the use of red, blue, green and white LED's.
- .6 All lumen values stated for luminaires in contract documentation or plans are stated as delivered lumens.
- .7 All LED sources to be tested in accordance with IESNA LM-80. Test data must be available for all luminaires.
- .8 All 'useful lifetime' projections for luminaire's to be calculated in accordance with IESNA TM-21-11. Unless otherwise noted, all luminaires to have minimum useful lifetimes to 70% of their original output (L70 ratings) of 50,000 hours.
- .9 LED drivers shall be electronic type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15 in compliance with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems".
- .10 LED drivers shall have a sound rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.
- .11 Dimmable LED drivers shall be 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker from 100%-1% of rated light output, unless noted otherwise.
- .12 Driver mA rating should be indicated when reporting initial delivered lumens of a specified fixture. Unless otherwise stated, no driver current shall exceed 750 mA.
- .13 LED lighting systems with unmatched drivers and power supplies will not be accepted.

2.2 LUMINAIRES

.1 Type LA

- .1 Light fixture is a round, low profile integrated wafer, residential grade LED, recess mounted into drywall ceiling.
- .2 Shall be IC rated for direct contact with insulation.
- .3 Dimensions are 120mm diameter, 75mm deep.
- .4 Light fixture source shall be a maximum of 15W LED, 1000 lumens, 3000°K colour temperature with 90+ CRI rating.
- .5 Lumen depreciation factor shall be 70% at 50,000 hours at 25°C.
- .6 Light fixture shall be complete with 10%-100% dimming capability, suitable for control for wall dimmer.
- .7 Finish shall be white.
- .8 Voltage shall be 120V.

.2 Type LB

- .1 Light fixture is a decorative, residential grade, integrated LED pendant.
- .2 Dimensions are 305mm tall, 200mm diameter.
- .3 Light fixture source shall be a maximum of 15W LED, 900 lumens, 3000°K colour temperature with 80+ CRI rating.
- .4 Lumen depreciation factor shall be 70% at 40,000 hours at 25°C.
- .5 Fixture shall be complete with frosted acrylic lens.
- .6 Light fixture shall be complete with 10%-100% dimming capability, suitable for control for wall dimmer.
- .7 Finish shall be black.
- .8 Voltage shall be 120V.

.3 Type LC

- .1 Light fixture is a decorative, round, residential grade, integrated LED ceiling mount fixture.
- .2 Dimensions are 90mm tall, 400mm diameter.
- .3 Light fixture source shall be a maximum of 25W LED, 2000 lumens, 3000°K colour temperature with 80+ CRI rating.
- .4 Lumen depreciation factor shall be 70% at 40,000 hours at 25°C.
- .5 Fixture shall be complete with frosted acrylic lens and black metal wrap trim around perimeter of fixture.
- .6 Light fixture shall be complete with 10%-100% dimming capability, suitable for control for wall dimmer.
- .7 Finish shall be black.
- .8 Voltage shall be 120V.

.4 Type LD

- .1 Light fixture is a decorative, drum style, residential grade, integrated LED pendant fixture.
- .2 Dimensions are 240mm tall, 500mm diameter.
- .3 Light fixture source shall be a maximum of 40W LED, 3000 lumens, 3000°K colour temperature with 80+ CRI rating.
- .4 Lumen depreciation factor shall be 70% at 40,000 hours at 25°C.
- .5 Fixture shall be complete with frosted acrylic lens, white fabric shade, black metal trim around perimeter of fixture and black metal pendant.
- .6 Light fixture shall be complete with 10%-100% dimming capability, suitable for control for wall dimmer.
- .7 Finish shall be black.
- .8 Voltage shall be 120V.

.5 Type LE

- .1 Light fixture is a decorative, residential grade, wall mounted vanity, integrated LED fixture.
- .2 Fixture shall be damp location listed.
- .3 Dimensions are 815mm long, 115mm wide, 115mm tall.
- .4 Light fixture source shall be a maximum of 40W LED, 3500 lumens, 3000°K colour temperature with 80+ CRI rating.
- .5 Lumen depreciation factor shall be 70% at 40,000 hours at 25°C.
- .6 Fixture shall be complete with frosted acrylic lens, black metal trim end caps and black metal mounting plate.
- .7 Voltage shall be 120V.

.6 Type LF

- .1 Light fixture is a round, low profile direct mount, residential grade LED, recess mounted into drywall ceiling.
- .2 Light fixture shall be wet location listed.
- .3 Dimensions are 140mm diameter, 30mm deep.
- .4 Fixture shall mount directly to standard junction box.
- .5 Light fixture source shall be a maximum of 10W LED, 700 lumens, 3000°K colour temperature with 90+ CRI rating.
- .6 Lumen depreciation factor shall be 70% at 50,000 hours at 25°C.
- .7 Finish shall be white.
- .8 Fixture shall be complete with domed, frosted acrylic lens
- .9 Voltage shall be 120V.

.7 Type LG

- .1 Light fixture is a round, low profile surface mount LED downlight, mounted to soffit.

- .2 Light fixture shall be wet location listed.
- .3 Dimensions are 140mm diameter, 30mm deep.
- .4 Fixture shall mount directly to standard junction box.
- .5 Light fixture source shall be a maximum of 10W LED, 700 lumens, 3000°K colour temperature with 90+ CRI rating.
- .6 Lumen depreciation factor shall be 70% at 50,000 hours at 25°C.
- .7 Finish shall be white.
- .8 Fixture shall be complete with domed, frosted acrylic lens
- .9 Voltage shall be 120V.
- .8 Type LH
 - .1 Light fixture is a ceiling mounted, commercial grade decorative LED wrap fixture with volumetric distribution.
 - .2 Fixture shall be complete with integral occupancy sensor for on/off occupancy operation.
 - .3 Dimensions are 1120mm long, 260mm wide, 100mm deep.
 - .4 Light fixture source shall be a maximum of 35W LED, 3900 lumens, 3000°K colour temperature with 80+ CRI rating.
 - .5 Lumen depreciation factor shall be 90% at 60,000 hours at 25°C.
 - .6 Fixture shall be complete with frosted, curved acrylic lens.
 - .7 Finish shall be white.
 - .8 Voltage shall be 120V.
- .9 Type LJ
 - .1 Light fixture is a soffit recessed, commercial grade, integrated LED shower downlight that is IP66 rated, wet location listed.
 - .2 Fixture shall be complete with flush, textured lens.
 - .3 Dimensions are 150mm diameter, 190mm high.
 - .4 Light fixture source shall be a maximum of 15W LED, 1200 delivered lumens, 3000°K colour temperature with 80+ CRI rating.
 - .5 Fixture shall be complete with medium wide distribution, 45° cutoff.
 - .6 Lumen depreciation factor shall be 70% at 60,000 hours at 25°C.
 - .7 Fixture shall be complete with frosted, curved, ribbed acrylic lens.
 - .8 Trim finish shall be black.
 - .9 Voltage shall be 120V.
- .10 Type LK
 - .1 Light fixture is an exterior architectural wall sconce, complete with rounded face.
 - .2 Fixture shall be IP65 rated, suitable for -40°C to +40°C ambient temperature.
 - .3 Dimensions are 400mm wide, 200mm high, 210mm deep.

- .4 Fixture shall be square LED configuration with 350mA drive current,
- .5 Light fixture source shall be a maximum of 25W LED, 2384 delivered lumens, 3000°K colour temperature with 80+ CRI rating.
- .6 Lumen depreciation factor shall be 98% at 60,000 hours at 25°C.
- .7 Fixture shall be complete with Type IV forward throw distribution.
- .8 Light fixture shall be controlled by integral photocell.
- .9 Finish shall be black.
- .10 Voltage shall be 120V.
- .11 Type LL
 - .1 Light fixture is a ceiling mounted, commercial grade LED strip fixture with narrow, semi-frosted acrylic lens.
 - .2 Dimensions are 1220mm long, 90mm wide, 90mm deep.
 - .3 Light fixture source shall be a maximum of 25W LED, 3463 delivered lumens, 4000°K colour temperature with 80+ CRI rating.
 - .4 Fixture shall suitable for -20°C to +40°C ambient temperature.
 - .5 Lumen depreciation factor shall be 87% at 60,000 hours at 25°C.
 - .6 Finish shall be white.
 - .7 Voltage shall be 120V.
- .12 Type LP1
 - .1 Light fixture is an outdoor pole mounted.
 - .2 Fixture shall be IP66 rated, suitable for -40°C to +40°C ambient temperature.
 - .3 Dimensions are 349 mm x 533 mm x 100 mm and arm.
 - .4 Light fixture source shall be 113 Watts, LED, 5100 delivered lumens, 3000°K colour temperature with 70+ CRI rating.
 - .5 Fixture shall be complete with Type IV forward throw distribution.
 - .6 Light fixture shall be controlled by integral photocell.
 - .7 Finish shall be black.
 - .8 Voltage shall be 120V.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Support luminaires from building structure.
- .3 Provide plaster frame and trim as required and turn over to trade providing ceiling installation.
- .4 Install recessed luminaires so that they can be completely removable from below finished ceiling.

- .5 Recessed downlights installed in t-bar ceilings shall be secured to blocking spanning between ceiling grid members. Secure recessed downlight to blocking to ensure that luminaire does not move when trim is adjusted or removed for servicing.
- .6 Recessed lighting luminaires in inaccessible ceilings shall be secured to blocking attached to building structure.
- .7 Where no finished ceiling exists, luminaires shall be suspended on rigid conduit hangers complete with ball aligner, and outlet box canopy. All suspension components shall be degreased and painted white, unless otherwise noted.
- .8 Replace fixtures, which in the opinion of the electrical consultant, are found to exhibit excessive noise.
- .9 Coordinate installation of luminaires with mechanical contractor to avoid conflicts between luminaires, and mechanical system components.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Install flexible or rigid conduit for luminaires. Maximum lengths of the flexible conduit in the ceiling not to exceed 3 m.
 - .2 Individually support all lighting fixtures wiring and flexible conduits, including control wiring, from structural members or slab. Flexible conduits and/or lighting harness not to be laid down on suspended ceiling or lighting fixtures.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support each luminaire from structural members or slab and independently of ceiling minimum in two (2) individual points.
- .2 Support luminaires mounted in continuous rows once every 3 m.

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 Maintain required heights, and install luminaires clear of other work.

3.5 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

3.6 FIELD QUALITY CONTROL

- .1 Perform a visual inspection to verify cleanliness and alignment of the fixtures. Misalignment and light leaks shall be corrected. Rattles due to ventilation system vibration shall be eliminated.
- .2 Perform an operational test to verify that all fixtures illuminate properly, dimming systems dim properly (no flicker), and lighting zones are switched according to the drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.141-15 (R2020), Emergency Lighting Equipment.
 - .2 CSA C22.1-21 Canadian Electrical Code, Part 1 25th Edition, Safety Standard for Electrical Installation.
- .2 National Building Code of Canada (NBC) 2015, with Revisions and Errata 2018.
- .3 National Fire Protection Association (NFPA)
 - .3 NFPA 101-2021, Life Safety Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .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 26 05 00 Common Work Results for Electrical.
- .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 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

1.6 WARRANTY

- .1 For batteries in this Section 26 52 13.13 Emergency Lighting, 12 months warranty period is extended to 120 months.

Part 2 Products

2.1 BATTERY UNITS

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V, AC.
- .3 Output voltage: 24 V DC.
- .4 Operating time: 60 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 disconnecting means: 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 as shown on the drawings, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 5W, minimum 400 lumen minimum output.
- .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: white.
- .13 Auxiliary equipment:
 - .1 Ammeter.
 - .2 Voltmeter.
 - .3 Test switch.
 - .4 Time delay relay.
 - .5 Battery disconnect device.
 - .6 AC input and DC output terminal blocks inside cabinet.
 - .7 Bracket.
 - .8 Cord and plug connection for AC.
 - .9 RFI suppressors.
- .14 Battery units with integral lamp heads noted on drawings as type EB.
- .15 Remote heads noted on drawings as type EC.

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT, in accordance with Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings.

- .2 Conductors: type in accordance with Section 26 05 21 Wires and Cables (0-1000 V), sized in accordance with manufacturer's recommendations, and to limit voltage drop not to exceed 5% of the applied voltage.
- .3 Remote heads to be connected to battery pack circuited to general area lighting in vicinity of remote heads.

Part 3 Execution

3.1 INSTALLATION

- .1 Install battery units and remote mounted fixtures as shown on the drawings.
- .2 Unit equipment shall be direct connected. Cord sets are not permitted.
- .3 Direct heads to path of egress.
- .4 Connect exit lights to unit equipment.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.141-15 (R2020), Emergency Lighting Equipment.
 - .2 CSA C860-11 (R2016), Performance of Internally-Lighted Exit Signs.
 - .3 CSA C22.1-21 Canadian Electrical Code, Part 1 25th Edition, Safety Standard for Electrical Installation.
- .2 National Building Code of Canada (NBC) 2015, with Revisions and Errata 2018.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 101-2021, Life Safety Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit operation and maintenance data for exit signs for incorporation into manual.

1.5 EXTRA MATERIALS

- .1 Provide one (1) spare exit sign.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.

Part 2 Products

2.1 STANDARD UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Pictogram of running person in green background to suit ISO 7010/3864-1 requirements and complete with white directional arrows, or no arrows, single or double face as required and shown on the drawings, universal mounting to suit wall/end/ceiling.
- .3 Slim profile with extruded aluminum housing and edge lit LED, type as shown on the drawings.
- .4 Lamps: multiple circuit LED so that one circuit or one LED does not degrade faceplate illumination.
- .5 Operating voltage 120 V AC/ 24V DC.
- .6 Operation: designed for 10 years of continuous operation without re-lamping.
- .7 Pictogram of running person in green background with removable white directional arrows to suit ISO 7010/3864-1 requirement.
- .8 Exit signs noted on drawings as type EA.

Part 3 Execution

3.1 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to 120 V exit light circuits and nearest battery unit.
- .3 Lock exit light circuit breaker in on position.
- .4 Where double arrows are shown, install 2 signs.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .2 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical and with manufacturer's written instructions.
- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .4 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 communication raceway systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.4 SYSTEM DESCRIPTION

- .1 Telecommunications raceways system consists of outlet boxes, cover plates, conduits, pull boxes, sleeves and caps, fish wires and service fittings.

Part 2 Products

2.1 MATERIALS

- .1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Junction boxes, cabinets type E: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .3 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .4 Fish wire: polypropylene type.

- .5 Coverplates:
 - .1 Port coverplate
 - .2 Construction and color as per Section 26 27 26 – Wiring Devices.
- .6 Voice Outlets:
 - .1 Flush type, snap-in inserts with encapsulated lead frame design and inline IDC terminating interface.
 - .2 Category 6, RJ-45.
 - .3 Suitable for 568A termination.
 - .4 White in colour.
- .7 Wall mounted Connectors for Voice:
 - .1 Fire retardant plastic construction with front and back IDC terminating strips.
 - .2 Suitable for terminating 22, 24, or 26 gauge plastic insulated solid copper conductors without stripping.
 - .3 Connection clips recessed to prevent accidental short circuit contact.
 - .4 Contact resistance < 1 Mohm / contact.
 - .5 Insulation resistance > 100 Mohm between clips.
 - .6 Provide quantity of connectors to accommodate all termination plus 25% future.
 - .7 Mount in wall mount connector mount of stamped steel, one piece construction and fire-retardant plastic fanning strips. Provide quantity to accommodate all connectors plus 25% future.
 - .8 Designation strips shall have fire retardant plastic construction and shall snap onto mounts between connectors. Provide ID labels with designation strips.
- .8 Suit Media Panel:
 - .1 Shall be recess style 30" enclosure style complete with hinged lid.
 - .2 Internal space shall be open with standardized mounting hole pattern for equipment.
 - .3 Shall be complete with multiple entry/exit knockouts on top and bottom of panel.
 - .5 Inside dimensions of 534mm high, 356mm wide, 102mm deep.

Part 3 Execution

3.1 INSTALLATION

- .1 Install empty raceway system, including distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, miscellaneous and positioning material to constitute complete system.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05 00 Common Work Results for Electrical.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical 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 communication raceway systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.4 SYSTEM DESCRIPTION

- .1 Provide complete operational Door Intercom System complete with exterior door release in the building.
- .2 The door intercom system shall allow visitors to the building to call a designated suite by push of a button connected to that suite. The selected suite shall be able to communicate by audio with the visitor. The visitor shall be given access to the building once the resident releases the locking mechanism on the exterior door by push of a button.

Part 2 Products

2.1 MATERIALS

- .1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings, size as shown on the drawings.

- .2 Communication conductors: type and size as shown on the drawings, in accordance with manufacturer's cable type and sizes, CMP and FT6 rated.

2.2 BUILDING ENTRANCE PANEL

- .1 Flush mounted, 14-gauge stainless steel, vandal resistant enclosure.
- .2 IP66 rated enclosure.
- .3 Alpha/numeric 12 button keypad and 'CALL' button.
- .4 Complete with blue 'In Use' LED indicating light.
- .5 Integral speaker/microphone complete with volume adjustments for microphone and speaker.
- .6 Panel is telephone line powered.
- .7 Capable of calling to hardwired suite intercom.
- .8 Required control relays.
- .9 Required power supplies.

2.3 SUITE INTERCOM PANEL

- .1 Constructed of stainless steel, vandal resistant metal button
- .2 Shall allow hands free operation.
- .3 Recessed in wall mounting.
- .4 Phone line powered.
- .5 IP66 rated enclosure.
- .6 Alpha/numeric 12 button keypad and 'CALL' button.
- .7 Integral speaker/microphone complete with volume adjustments for microphone and speaker.
- .8 Capable of answering calls from building entrance panel.
- .9 Required control relays.
- .10 Required power supplies.
- .11 Shall allow release of front door locking mechanism by release of button or sequence of buttons.

2.4 NSL RELAY CABINET

- .1 Contain the telephone switching equipment required to operate the building entrance intercom system.
- .2 Allow the telephone switching functionality to facilitate voice communications between the residents intercom panel and the exterior control panel.
- .3 Provide access control by the resident using the intercom panel keypad.
- .4 Cabinet shall consist of main controller board and backplane board.
- .5 Relay board contains up to eight (8) relay boards.

2.5 WALL MOUNT CONNECTORS FOR VOICE

- .1 Fire retardant plastic construction with front and back IDC terminating strips.
- .2 Suitable for terminating 22, 24, or 26 gauge plastic insulated solid copper conductors without stripping.
- .3 Connection clips recessed to prevent accidental short circuit contact.
- .4 Contact resistance < 1 Mohm / contact.
- .5 Insulation resistance > 100 Mohm between clips.
- .6 Provide quantity of connectors to accommodate all termination plus 25% future.
- .7 Mount in wall mount connector mount of stamped steel, one piece construction and fire retardant plastic fanning strips. Provide quantity to accommodate all connectors plus 25% future.
- .8 Designation strips shall have fire retardant plastic construction and shall snap onto mounts between connectors. Provide ID labels with designation strips.

2.6 WARRANTY AND MAINTENANCE

- .1 Provide a written warranty that the system components installed shall be free from defects in parts or assembly for a 1-year period from date of substantial inspection.

Part 3 Execution

3.1 INSTALLATION

- .1 Install system in accordance with manufacturer's instructions.
- .2 Interconnect system components.
- .3 Refer to electrical drawings for further details and information.

3.2 CLEANING

- .1 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05
00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .2 Treasury Board of Canada (TBS), Occupational Safety and Health (OSH)
 - .1 Fire Protection Standard-10.
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-2014, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S526-2016, Visible Signal Devices for Fire Alarm Systems, Including Accessories.
 - .3 CAN/ULC-S527-2019, Standard for Control Units for Fire Alarm Systems.
 - .4 CAN/ULC-S528-2014, Manual Stations for Fire Alarm Systems, Including Accessories.
 - .5 CAN/ULC-S529-2016, Smoke Detectors for Fire Alarm Systems.
 - .6 CAN/ULC-S530-91(R2018), Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S531-2019, Standard for Smoke Alarms.
 - .8 CAN/ULC-S537-2013, Standard for the Verification of Fire Alarm Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for multiplex fire alarm system and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate on shop drawings:
 - .1 Detail assembly and internal wiring diagrams for control unit.

- .2 Overall system riser wiring diagram identifying control equipment, initiating zones, signaling circuits; identifying terminations, terminal numbers, conductors and raceways.
- .3 Details for devices.
- .4 Details and performance specifications for control, annunciation and peripherals with item-by-item cross reference to specification for compliance.
- .5 Step-by-step operating sequence, cross referenced to logic flow diagram.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: submit operation and maintenance data for fire alarm system for incorporation into manual.
- .3 Include:
 - .1 Instructions for complete fire alarm system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.
 - .4 List of recommended spare parts for system.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical 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 materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: as specified in Section 26 05 00 Common Work Results for Electrical.

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 location via fire alarm monitoring transmitting signal device..
- .3 Zoned, non-coded single stage.
- .4 Modular in design to allow for future expansion.
- .5 The operation of the 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/signaling.
 - .2 Power supplies.
 - .3 Initiating/input circuits.
 - .4 Output circuits.
 - .5 Auxiliary circuits.
 - .6 Wiring.
 - .7 Manual and automatic initiating devices.
 - .8 Audible and visual signaling devices.
 - .9 End-of-line resistors.
 - .10 ULC listed fire alarm signal transmitting device.
- .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 Visual signal devices: to CAN/ULC-S526
- .11 Control unit: to CAN/ULC-S527
- .12 Manual pull stations: to CAN/ULC-S528
- .13 Thermal detectors: to CAN/ULC-S530
- .14 Smoke detectors: to CAN/ULC-S529
- .15 Smoke alarms: to CAN/ULC-S531

.16 Regulatory Requirements:

- .1 System components: listed by ULC and comply with applicable provisions of NBC, Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

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 and remote annunciator.
- .3 Cause audible signaling devices to sound continuously throughout building and at central control unit.
- .4 Transmit signal to fire department via fire alarm transmitting device.
- .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 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 Possible to silence signals located within individual dwelling units using the silence pushbuttons within the dwelling units for a period of not than 10 minutes after which they shall be restored to normal operation.

.6 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 and at remote annunciator.
- .3 Cause audible signal at central control unit to sound.
- .4 Activate common supervisory sequence.

.7 Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit has been reset.

.8 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.

.9 Trouble on system: suppressed during course of alarm.

- .10 Trouble condition on any circuit in system not to initiate alarm conditions.

2.3 CONTROL PANEL

- .1 Central control unit (CCU).
- .1 Suitable for DCLB 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 500 addressable monitoring and 250 addressable control/signal points.
 - .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 Communication between CCU and remote DGP's/TPR's to be supervised, DCLB. Should communications fail between CCU and remote units, audible and visual trouble to be indicated at CCU. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 3,000 m.
 - .9 Support up to 2 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.
 - .10 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.
 - .11 Software and hardware to maintain time of day, day of week, day of month, month and year.
 - .12 Software to operate variable sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

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 conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.
- .6 Standby batteries: sealed, maintenance free.
- .7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained for 24 hours.
- .8 Continuous operation of fire alarm system under full load, immediately following 24 hour period, for not less than 30 minutes.

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 DCLB configuration to fault isolation modules.
- .2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.
- .3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".
- .4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLB configuration to fault isolation modules.
- .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. Each signal circuit: rated at 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 and/or supervisory trouble on system to cause operation of programmed auxiliary output circuits.
- .4 2 sets of separate contacts for elevator capture to main floor of egress and to alternate floor of egress.
- .5 Upon resetting the system, auxiliary contacts to return to normal or to operate as pre-programmed.
- .6 Auxiliary circuits: rated at 2 A, 24 Vdc or 120 Vac, fuse-protected.

2.8 WIRING

- .1 FAS multi-conductor copper wire, rated 300 V, PVC insulated, Red PVC outer jacket. Armored where not installed in conduit.
- .2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
- .3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
- .4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

2.9 MANUAL ALARM STATIONS

- .1 Addressable manual pull station.
 - .1 Pull lever, break glass rod, surface wall mounted type, 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.

2.10 AUTOMATIC ALARM INITIATING DEVICES

- .1 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 88 degrees C, rate of rise 8.3 degrees C per minute.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector base in field.
- .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.
- .3 Addressable variable-sensitivity smoke detectors.
 - .1 Photo-electric type.

- .2 Electronics to communicate detector's status to addressable module/transponder.
- .3 Detector address to be set on detector base in field.
- .4 Sensitivity settings: 7 settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.
- .5 Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.
- .4 Addressable duct smoke detector.
 - .1 Photo-electric type.
 - .2 Detector address to be set on unit.
 - .3 Unit shall operate in air velocities from 0.5 to 20.32 m/sec.
 - .4 Integral dust filter system.
 - .5 Sampling tube.

2.11 AUDIBLE SIGNAL DEVICES

- .1 Wall or ceiling mounted as shown on the drawings.
- .2 White finished.
- .3 Minimum output 88 dBA @ 3m.
- .4 Volume settings: 2.
- .5 Tone selection: set to temporal.
- .6 Devices in sleeping rooms shall emit a low frequency signal.
- .7 Tamper resistant.

2.12 AUDIBLE VISUAL SIGNAL DEVICES

- .1 Wall mount with flush back box.
- .2 White finished with lettering 'FIRE'
- .3 Minimum output 90 dBA @ 3m.
- .4 Volume settings: 3.
- .5 Tone selection: set to temporal.
- .6 Tamper resistant.
- .7 Integral strobe centered in horn.
- .8 Field selectable strobe candela settings: 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177 and 185. Set to 75 cda.

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 REMOTE ANNUNCIATORS

- .1 LED remote alphanumeric type, with designation cards to indicate zones.
- .2 Display:
 - .1 Alarms and troubles for alarm initiating circuits.
 - .2 Common supervisory alarm for supervisory initiating circuits.
 - .3 Common system trouble.
- .3 Trouble buzzer:
 - .1 Acknowledging trouble at main panel to silence trouble buzzers in system.
- .4 Supervised, with LED test button and alarm trouble acknowledge button.
- .5 Minimum wiring configuration with main panel and other remote annunciators.

2.15 SYSTEM TYPE CARBON MONOXIDE DETECTORS

- .1 Electronics to communicate detector's status to addressable module/transponder.
- .2 Integral audible device to provide 85 dBA at 3m.
- .3 Complete with one (1) alarm contact and one (1) trouble contact.
- .4 Connect unit as a supervisory device only.
- .5 Six year end-of-life timer to signal at end of life.

2.16 STAND ALONE DUAL SOURCE CARBON MONOXIDE DETECTORS

- .1 120V / 9V Battery operation.
- .2 Test / silence pushbutton.
- .3 Metal Oxide sensor.
- .4 Integral audible device to provide 85 dBA at 3m.
- .5 Inter-connectable to other CO detectors or smoke alarms.

2.17 STAND ALONE DUAL SOURCE SMOKE ALARMS

- .1 120V / 9V Battery operation.
- .2 Test / silence pushbutton.
- .3 Photoelectric type.
- .4 Integral audible device to provide 85 dBA at 3m.
- .5 Inter-connectable to other CO detectors or smoke alarms.

2.18 STAND ALONE DUAL SOURCE COMBINATION CO / SMOKE ALARMS

- .1 120V / 9V Battery operation.
- .2 Test / silence pushbutton.
- .3 Metal Oxide sensor for CO detector and Photoelectric type for smoke alarm
- .4 Integral audible device to provide 85 dBA at 3m.
- .5 Inter-connectable to other CO detectors or smoke alarms.

2.19 REMOTE SILENCE SWITCH

- .1 Manually silences audible device for 10 minutes and then unit shall resume operation.
- .2 Unit operates in conjunction with a standard isolation module. Isolation module shall be labelled with the suite that it serves using a self-adhesive printed label. Coverplate of the isolation module shall have an identifying label indicating device function
- .3 Push to silence button located and labelled on front of device.
- .4 White in color.

2.20 MONITOR MODULES

- .1 Single or dual configuration, addressable.
- .2 Operating Voltage: 15 to 22VDC
- .3 Maximum Current: 5.0mA
- .4 Maximum Operating Current: .375mA
- .5 Maximum IDC wiring resistance: 1500 ohms
- .6 EOL Resistance: 47,000 ohms.
- .7 Coverplate shall have an identifying label indicating device function.

2.21 RELAY MODULES

- .1 Addressable complete with two (2) Form C contacts.
- .2 Operating Voltage: 15 to 32VDC
- .3 Average Operating Current: .250mA
- .4 Maximum Current Draw: 6.5mA
- .5 Maximum Contact Voltage Rating: 125VAC @ .3A
- .6 Coverplate shall have an identifying label indicating device function.

2.22 FAULT ISOLATOR MODULE

- .1 Unit shall provide automatic isolation of wire to wire short circuits on an SLC loop.

- .2 Operating Voltage: 15 to 32VDC.
- .3 Coverplate shall have an identifying label indicating device function. Provide type written label indicating the fire alarm zone in which it serves.

2.23 FIRE ALARM SIGNAL TRANSMITTER

- .1 Fire alarm signal transmitter shall provide data transmission from the fire alarm control panel in each building to the Base fire hall.
- .2 Cabinet dimensions shall be 305mm high, 267mm wide, 77mm deep.
- .3 Transmitter shall be capable of serial or IP connection. Provide microhard bullet wireless router complete with all required cabling and programming to connect the fire alarm panel to the base fire hall.
- .4 Inputs are programable to be normally open (NO) or normally closed (NO) and are supervised with end of line resistors. Inputs are programmable to be either alarm or supervisory.
- .5 Eight (8) supervised input zones.
- .6 Door tamper switch and alarm connection.
- .7 120V integral power supply. Provide 24 hour battery back up.
- .8 Thirty minute delay on AC Fail/Brownout.
- .9 Field programmable with DIP switch. Programming completed on site shall connect Transmitter to the base fire hall.
- .10 Allow for programming

2.24 AS-BUILT RISER DIAGRAM

- .1 Fire alarm system riser diagram: in glazed frame on black lamicoid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

Part 3 Execution

3.1 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524 and TB Fire Protection Standard.
- .2 Install fire alarm monitoring panel in accordance with CAN/ULC S561.
- .3 Install central control unit and connect to ac power supply, dc standby power.
- .4 Install manual alarm stations and connect to alarm circuit wiring.
- .5 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. Locate duct type detectors in straight portions of ducts.
- .6 Connect alarm circuits to main control panel.

- .7 Install horns and visual signal devices and connect to signaling circuits.
- .8 Connect signaling circuits to main control panel.
- .9 Install end-of-line devices at end of alarm and signaling circuits.
- .10 Install remote annunciator panels and connect to annunciator circuit wiring.
- .11 Install door releasing devices.
- .12 Install remote relay units to control fan shut down.
- .13 Install Fault Isolator, Relay, Monitor, and Silencing Modules such that they are visible and accessible. Flush mount in accessible ceilings where height does not exceed 2660mm (12 ft). Flush mount in walls at standard mounting height where ceiling are non-accessible or ceiling exceed above noted height.
- .14 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .15 Splices are not permitted.
- .16 T-Tapping or t-style connections are not permitted for initiating, control or monitoring devices.
- .17 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- .18 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .19 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.
- .20 Run fire alarm wire in conduit. Refer to Section 26 05 21 Wires and Cables (0-1000 V) for acceptable use of armored cables.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 Common Work Results for Electrical and CAN/ULC-S537.
- .2 Fire alarm system:
 - .1 Test such device and alarm circuit to ensure manual stations, thermal and smoke detectors and sprinkler system transmit alarm to control panel and actuate first stage alarm, general alarm and ancillary devices.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of systems.
 - .4 Addressable circuits system style DCLB:
 - .1 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open-circuit fault condition imposed near electrically most

remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

- .2 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

3.3 DEMONSTRATION AND TRAINING

- .1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.4 VERIFICATION AND CERTIFICATION OF THE FIRE ALARM EQUIPMENT

- .1 The contractor shall retain the services of the fire alarm system manufacturer's authorized factory representative to verify and certify fire alarm system operation.
- .2 Verification shall not occur until the building is in a dust-free, painted state and ready for occupancy in the area intended to be verified. The manufacturer's authorized factory representative shall:
 - .1 Inspect all fire alarm equipment to ensure installation conforms to the manufacturer's recommendations.
 - .2 Test all alarm initiating devices to ensure each device is operable and will initiate alarm and trouble signals as specified.
 - .3 Test all alarm indicating devices to ensure each device operates upon alarm and is correctly wired to provide supervision.
 - .4 Verify that all magnetic holding devices release as specified.
 - .5 Verify that all mechanical ventilation equipment controlled by the fire alarm system shuts down upon alarm. Note: Verifying control module contact operation only is not allowed. Actual equipment shut downs must be verified.
 - .6 Verify that all sprinkler system tamper and flow switches are correctly wired and initiate the required alarm and trouble signals. Note: Simulation of sprinkler tamper and flow switch operation only is not allowed. Tamper and flow switches must be operated to verify correct connection.
 - .7 Verify sound levels of audible devices. Sound level testing shall not occur until all building partitions and finishes affecting acoustics are installed, including but not limited to doors, walls, windows, ceilings, and flooring.
- .3 The contractor shall provide the manufacturer's authorized representative with sufficient personnel during system identification.
- .4 Personnel required to be on site during verification shall include Fire Hall Representative, DCC Representative, fire alarm contractor, fire alarm system

installed and third-party fire alarm engineer. Provide minimum of 72 hours' notice prior to verification occurring.

- .5 The manufacturer's authorized representative shall provide the contractor with technical assistance to correct deficiencies identified during the verification.
- .6 Submit the following on completion of the verification and when all of the conditions have been complied with:
 - .1 A Certificate of Verification and copies of the verification worksheet that the fire alarm system has been completed as per CAN/ULC S537, and that the system is fully operational.
 - .2 A Certificate of Verification and copies of the verification worksheet that the installation and testing of the fire alarm monitoring panel has been completed as per CAN/ULC S561 and that the unit is functional.
 - .3 A certificate/documentation indicating that the fire alarm monitoring panel is communicating with and being monitored by a ULC listed monitoring agency.
- .7 All costs involved in this inspection to be included in the total tender price.

3.5 INTEGRATED LIFE SAFETY SYSTEMS TEST

- .1 At the completion of construction but prior to deeming the contract substantially complete, the contractor shall carry out an integrated life safety systems test.
- .2 This test shall include the following:
 - .1 Demonstrate that all ancillary functions that are initiated by the fire alarm system operate as specified.
 - .2 Demonstrate the continued operation of all of the functions noted above while the building power supply has been turned off.
 - .3 Demonstrate the continued operation of all of the functions noted above during the restoration of the building power supply.
 - .4 The DCC Representative shall prepare a detailed sequence of events prior to the test. The contractor shall arrange for personnel to assist in the test including other sub trades.

3.6 CLEANING

- .1 Progress and Final Cleaning in accordance with Section 26 05 00 Common Work Results for Electrical.
 - .1 Waste Management in accordance with Section 26 05 00 Common Work Results for Electrical.

3.7 PROTECTION

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

3.8 CLOSEOUT ACTIVITIES

- .1 Provide on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 – Earthwork, Trenching and Backfilling.
- .2 Section 01 35 43 – Environmental Procedures

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D 698-12R21, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .2 CSA International
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A3000-18, Cementitious Materials Compendium.
- .3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation
 - .1 OPSS.MUNI 1004 Nov 2021, Material Specification for Aggregates - Miscellaneous.
 - .2 OPSS.MUNI 1010 Nov 2013, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
 - .3 OPSS.PROV 578 Apr 2017, Construction Specification for the Placement of Unshrinkable Fill.
 - .4 OPSS.MUNI 1359 Nov 2016, Unshrinkable Backfill.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.
 - .1 Contractor to coordinate relocation of buried services.
 - .2 Contractor to contact DCC Representative if existing conditions vary from contract prior to proceeding with any extra work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Identify and provide gradation analysis and environmental testing in accordance with Section 01 35 43 – Environmental Procedure.
- .3 Site Quality Control Submittals: submit in accordance with Section 01 45 00 - Quality Control.

- .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article.
- .2 Submit testing results and report as described in PART 3 - FIELD QUALITY CONTROL.

1.5 EXISTING CONDITIONS

- .1 Examine soil reports as referenced in Part 3 Clause 3.1.1.1.
- .2 Buried services:
 - .1 Before commencing work verify 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.
 - .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 Confirm location of buried utilities by careful test excavations or soil hydrovac methods.
 - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone, and other utilities and structures encountered.
 - .7 Where utility lines or structures exist in area of excavation, obtain direction of DCC Representative before removing, re-routing.
 - .8 Record location of maintained, re-routed and abandoned underground lines.
 - .9 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Confirm all existing topographical features before commencing work to verify existing conditions for design purposes.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Granular A and Granular B to OPSS 1010.
 - .1 Iron blast furnace slag or nickel slag is not acceptable.
- .2 Sand to OPSS 1004.
- .3 Unshrinkable fill to OPSS 578, OPSS 1359, proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Portland cement content of 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 hours.
 - .4 Concrete aggregates: to CSA A23.1/A23.2.
 - .5 Cement: to CSA A3000, Type GU.

- .6 Slump: 160 to 200 mm.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Evaluation and Assessment:
- .1 Examine the CFHA Apartments Geotechnical Investigation Report dated November, 2019 prepared by Ainley Group.
 - .2 Before commencing work, establish locations of buried services on and adjacent to site.

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 the sediment and erosion control drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Protection of in-place conditions:
- .1 Protect excavations from freezing.
 - .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's 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 Removal:
- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
 - .1 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.
 - .2 Remove stumps and tree roots below footings, concrete slabs, and paved areas, and to 600 mm below finished grade elsewhere.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial regulations.
- .2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
 - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected
 - .2 Stockpile topsoil on site for later use.
 - .3 Dispose excess topsoil as directed by DCC Representative.
- .3 Excavate as required to carry out work, in all material met.
 - .1 Do not disturb soil or rock below bearing surfaces.
 - .2 Notify DCC Representative when excavations are complete.
 - .3 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
 - .4 Excavation taken below depths shown without DCC Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .4 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground.
 - .1 Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .5 Excavate for slabs and paving to subgrade levels.
 - .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill, fill and unshrinkable fill will be carried out by a testing laboratory designated by DCC Representative.
- .2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Do not begin backfilling or filling operations until material has been approved for use by DCC Representative.
- .4 No later than 48 hours before backfilling or filling operation, notify DCC Representative to allow compaction tests to be carried out by designated testing agency.

3.5 BACKFILLING

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .3 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
 - .1 Fill excavated areas with selected subgrade material compacted as specified for fill.
- .4 Placing:
 - .1 Place backfill, fill and base course material in 150 mm lifts: add water as required to achieve specified density.
 - .2 Place unshrinkable fill in area as indicated: consolidate and level unshrinkable fill with internal vibrators.
- .5 Compaction: compact each layer of material to following densities for material to ASTM D 698:
 - .1 To underside of base courses: 95%.
 - .2 Base courses: 100%.
 - .3 Elsewhere: 95%.
- .6 Under slabs and paving:
 - .1 Use Select Subgrade material up to bottom of granular sub-base courses.
 - .2 Use Granular A for base courses.
- .7 In trenches:
 - .1 Up to 300 mm above pipe or conduit: Granular A.
 - .2 Over 300 mm above pipe or conduit: Native Material approved by DCC Representative.
- .8 Seeded and sodded areas: use site excavated material to bottom of topsoil except over trenches and within 600 mm of foundations.
- .9 Against foundations (except as applicable to trenches and under slabs and paving): use excavated material or imported material with no stones larger than 100 mm diameter within 600 mm of structures.

3.6 CONTAMINATED MATERIALS

- .1 Work to be in accordance with Section 01 35 43 – Environmental Procedure.

3.7 GRADING

- .1 Grade all surfaces so that water will drain away from buildings and walls to catch basins and other disposal areas approved by the DCC Representative.
 - .1 Grade to be gradual between finished spot elevations shown on drawings.

3.8 TOPSOIL PLACEMENT

- .1 Place a minimum of 150 mm of topsoil under areas as indicated.
- .2 DCC Representative to inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.9 SHORTAGE AND SURPLUS

- .1 Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.
- .2 Dispose of surplus material off site.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Areas disturbed due to the Work is to be restored to pre-work conditions.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 32 11 23 Aggregate Materials.

1.2 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS.MUNI 1010 November 2013 Material Specification for Aggregates – Base, Subbase, Select Subgrade and Backfill Material.
 - .2 OPSS.MUNI 1004 November 2021 Material Specification for Aggregates – Miscellaneous.
- .2 ASTM International
 - .1 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³ (600kN-m/m³)).
 - .6 ASTM D1557-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .7 ASTM D1883-21, Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils.
 - .8 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .9 ASTM D4791-19 Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.3 APPROVAL

- .1 Incorporate only approved materials into the work or stockpile.
- .2 Advise the DCC Representative of proposed material sources 4 weeks in advance of aggregate use, so that samples may be taken and tests may be made.

- .3 Materials shall be subject to sampling and testing by DCC Representative at all times. Provide DCC Representative with ample opportunity to sample any material at any time.

1.4 SAMPLING AND TESTING

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Samples for quality testing will be required for all aggregates. Unless otherwise by the specified DCC Representative, initial samples for quality testing may be of the material in their natural state. Subsequent and progress samples for quality testing shall be taken of the processed materials.
- .3 Samples shall be taken by DCC Representative or his representative.
- .4 The time required for quality testing, after receipt of the samples in the laboratory will be three (3) weeks.
- .5 Open the proposed source at the face by test pit or by drilling at own expense so that representative samples may be taken.
- .6 Testing of aggregates will be carried out in accordance with ASTM methods listed in Section 1.2 Reference Standards.
- .7 Aggregates having at least one fractured face will be considered as crushed material.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 Storage: store washed materials or materials excavated from underwater 24 hours minimum, to allow free water to drain and for materials to attain uniform water content.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Material as per Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS.MUNI 1010.
 - .2 OPSS.MUNI 1004.
- .2 The specific aggregate requirements shall be as detailed in the material specification for the type of material provided.
- .3 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent

coating and injurious amounts of disintegrated pieces or other deleterious substances.

- .4 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed 5 times their least dimension.
- .5 Fine aggregate satisfying all requirements of the specification unless otherwise provided therein, shall be one, or a blend of the following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in the crushing of quarried rock, boulders or gravel.
- .6 Coarse aggregates satisfying all requirements of the specification unless otherwise provided therein, shall be one of the following:
 - .1 Crushed rock.
 - .2 Gravel composed of naturally formed particles of stone.

2.2 SOURCE QUALITY CONTROL

- .1 Inform DCC Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before start production.
- .2 If, in opinion of DCC Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Should a change of source of material be proposed during the work, advise the DCC Representative four (4) weeks in advance of proposed change of material source to allow samples to be taken and tests made.
- .4 The acceptance of any material shall not preclude its future rejection if it is subsequently found to lack uniformity, or of it fails to conform to the requirements specified, or if its field performance is found to be unsatisfactory.

Part 3 EXECUTION

3.1 HANDLING

- .1 Handle and transport aggregates in a manner and with equipment that will avoid segregation, contamination and degradation.

3.2 PROCESSING

- .1 Process aggregates uniformly using methods that prevent contamination, segregation and degradation.

- .2 Blend aggregates, as required, to obtain gradation requirements for material and, percentage of crushed particles, or particle shapes, as specified.
 - .1 Use methods and equipment approved by DCC Representative.
- .3 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogenous aggregate.
- .4 Wash aggregates, if required to meet specifications. Use only equipment approved by DCC Representative.

3.3 STOCKPILING

- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by DCC Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Stockpiling sites to be level, well drained, free of all foreign materials and of adequate bearing capacity to support the weight of the materials to be placed thereon and the handling equipment.
- .4 Separate different aggregate stockpiles by dividers or stockpile far enough apart to prevent intermingling / intermixing.
- .5 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by DCC Representative within 48 hours of rejection.
- .6 For all coarse aggregates except where stockpiled on Portland cement or asphaltic concrete foundations or otherwise acceptably stabilized areas, provide a compacted sand stockpile base not less than 300 mm in depth to prevent contamination of the material.
- .7 For fine or combined aggregate stockpiles, the foundation shall be as specified above for coarse aggregates, or unless otherwise required by the DCC Representative, fine and combined aggregate stockpiles may be placed on the ground, provided that the bottom 300 mm of the pile is not incorporated into the work.
- .8 Build stockpiles in layers not exceeding 1.5 m in depth; complete each layer over the entire area of the stockpile before beginning the next layer.
 - .1 Stockpile materials in uniform layers of thickness.
- .9 Uniformly spot-dump aggregates delivered to the stockpile in trucks and build the stockpile as specified.
- .10 Coning of the piles or spilling of material over the edges of the pile not permitted.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.4 DEFECTIVE MATERIALS

- .1 Unless otherwise permitted by DCC Representative, remove rejected materials from the site of the work within 48 hours of such rejection.

3.5 CLEANING

- .1 Leave work area clean at end of each day.
- .2 Leave aggregate stockpile site in tidy, well drained conditions, free of standing surface water.
- .3 Leave any unused aggregates in neat compact stockpiles as directed by DCC Representative.
- .4 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of local authority having jurisdiction.
- .5 Final Cleaning: upon completion remove surplus material, rubbish, tools and equipment in accordance with Section 01 74 00.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 43: Environmental Procedure.
- .2 Section 31 23 33.01: Excavating, Trenching and Backfilling.

1.2 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.MUNI 201 Apr. 2019 – Construction Specification for Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders.
- .2 Ontario Environmental Protection Act, R.S.O. 1990, C. E.19.
- .3 Canadian Environmental Protection Act, 1999.

1.3 DEFINITIONS

- .1 Clearing: consists of cutting off all standing trees, brush, bushes, and other vegetation to a maximum height of 300 mm above original ground level and the removal/disposal of felled materials/trees, windfalls, previously uprooted trees and stumps, and surface debris.
 - .1 Close-cut Clearing: consists of cutting off all standing trees, brush, scrub, roots, stumps and embedded logs, bushes, and other vegetation at or close to original ground level and the removal/disposal of felled materials, windfalls, and surface debris.
 - .2 Clearing Isolated Trees: consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
 - .3 Underbrush Clearing: consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of all felled materials and debris.
- .2 Grubbing: consists of excavation and disposal of all stumps, roots, embedded logs, debris, and secondary growth.
- .3 Piled Boulders: consists of cobbles, boulders, or rock fragments that have been placed in fencerows or piles.
- .4 Surface Boulders: consists of any boulder or rock fragment that measures 200 mm or greater in any one dimension, extends a minimum of 200 mm above original ground, and can be removed without excavation.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Arrange for a site meeting, before Work starts, with DCC Representative in accordance with 01 31 19 – Project Meetings to:
 - .1 Verify project requirements.
 - .2 Examine existing site conditions and adjacent areas to construction's work, before work starts.
 - .3 Identify potential environmental impact on existing site conditions, in accordance with Section 01 35 34 10 – Site Clearing and Plant Protection
- .2 Contractor is responsible for obtaining or coordinating any permits required for clearing and grubbing works.

1.5 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – submittal Procedures.
- .2 Submit site-specific Health and Safety Plan (HSP), within seven (7) days after date of Notice to Proceed and before mobilization to site, in accordance with Section 01 70 12 – Safety Requirements. Submit HSP for review by DCC Representative.

1.6 HEALTH AND SAFETY

- .1 Perform clearing and grubbing work in accordance with the site specific HSP recommendations.
- .2 Safety requirements: worker protection.
 - .1 Ensure workers are wearing gloves, dust masks, eye protection, protective clothing, safety boots, safety vests while performing clearing and grubbing activities.
 - .2 Ensure workers are wearing gloves, dust masks, eye protection, protective clothing, when applying herbicide material.
 - .3 Ensure that workers are not allowed to eat, drink or smoke while applying herbicide material.
 - .4 Clean up spills of preservative materials immediately with absorbent material and safely discard them.

1.7 QUALITY CONTROL

- .1 Regulatory requirements:
 - .1 Ensure Work is performed in compliance with applicable national, provincial, and municipal regulations.
 - .2 Comply with hauling and disposal regulations of authority having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, root systems of trees which are to remain.
 - .1 Repair damaged items to approval of DCC Representative.
 - .2 Replace any damaged trees designated to remain, as directed by DCC Representative.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.
- .3 Trim limbs and tops, and saw into saleable length but in no case exceeding 5.0 m. Stockpile adjacent to site as directed by DCC Representative.
 - .1 All timber not purchased by others or stacked for adjacent landowners is excess material.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Not applicable.

Part 3 EXECUTION

3.1 PREPARATION

- .1 Inspect site and verify with DCC Representative, any items designated to remain.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing the site.
 - .1 Notify DCC Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify DCC Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing and grubbing.
- .4 Keep roads and walks free of dirt and debris.

3.2 CLEARING

- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.

- .2 Clear as indicated, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground.
- .3 Cut off branches and cut down trees overhanging area cleared as directed by DCC Representative.
- .4 Cut off unsound branches on tress designated to remain as directed by DCC Representative.

3.3 CLOSE CUT CLEARING

- .1 Close cut clearing to original ground level.
- .2 Cut off branches down trees overhanging area cleared as directed by DCC Representative.
- .3 Cut off unsound branches on tress designated to remain as directed by DCC Representative.

3.4 ISOLATED TREES

- .1 Cut off isolated trees as indicated at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.

3.5 UNDERBRUSH CLEARING

- .1 Under clearing in accordance with Clause 3.2 above.

3.6 GRUBBING

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimensions, but less than 0.25 m³.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.7 REMOVAL AND DISPOSAL

- .1 Remove cleared and grubbed materials off site to disposal area designated by DCC Representative.

3.8 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading, stripping of topsoil to approval of DCC Representative.

3.9 CLEANING

- .1 Perform cleaning in accordance with Section 01 74 00 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Maintain tidy Work area, free from accumulation of waste products and debris.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 53 - Identification for Mechanical Piping and Equipment
- .2 Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment

1.2 REFERENCE STANDARDS

- .1 ASTM International:
 - .1 ASTM C33/C33M-23, Standard Specification for Concrete Aggregates
 - .2 ASTM D3786/D3786M-18(2023), Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
 - .3 ASTM D4533/D4533M-15(2023), Standard Test Method for Trapezoid Tearing Strength of Geotextiles
 - .4 ASTM D4632/D4632M-15a(2023), Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 - .5 ASTM D4833/D4833M-07(2020), Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
 - .6 ASTM D5261-10(2018), Standard Test Method for Measuring Mass per Unit Area of Geotextiles
 - .7 ASTM E154/E154M-08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
 - .8 ASTM E1745-17(2023), Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- .2 US Environmental Protection Agency (EPA):
 - .1 EPA 625-R-92-016-1994, Radon Prevention in the Design and Construction of Schools and Other Large Buildings
- .3 Health Canada:
 - .1 Guide for Radon Measurements in Public Buildings – 2021
 - .2 Guide for Radon Measurements in Residential Dwellings – 2017
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)

1.3 SUBMITTALS

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

- .1 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, physical size, finishes, and limitations.
- .2 Submit WHMIS SDS - Safety Data Sheets.
- .3 Include geotextile fabric, gas permeable venting layer, membrane barrier system, collection/extension/riser piping, and sealing methods for slab perimeters and penetrations.
- .3 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Closeout Submittals:
 - .1 Perform in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Provide maintenance data for incorporation into O&M manual.
 - .3 Provide final as-built drawings indicating final locations of collection/extension/riser pipes.

1.4 QUALITY CONTROL

- .1 Installation: radon mitigation rough-in system is to be installed by competent and skilled workers with vapour barriers, sealants, and waterproofing membranes.
- .2 Installation workers are to obtain appropriate training on radon mitigation systems from component product manufacturers.

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 instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and product identification.
- .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 products from damage.
 - .3 Replace defective or damaged materials with new.

1.6 ENVIRONMENTAL/SITE CONDITIONS

- .1 Perform installation work when weather conditions are within installation guidelines established by manufacturer.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 If post turnover long term radon testing results indicate rough-in system needs to be activated, installed components of the rough-in subfloor depressurization system are to provide radon gas extraction points from within building. The system is intended to address protection from radon ingress and provide a means to address high radon concentrations post construction, as required.
- .2 Radon testing and extraction system activation are to be completed by the owner following turnover as per the per current Health Canada guidelines.

2.2 MATERIALS

- .1 All system components: to ASTM E154, chemically compatible with soil environment.
- .2 Collection, extension, and riser pipes: minimum Schedule 40 non-perforated smooth walled 100 mm (inside) diameter rigid pipe of PVC.
- .3 Pipe Hangers: Provide hangers to support the piping from the slab in accordance with 230529 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Hangers, rod and hardware to be stainless steel.
- .4 Gas permeable venting layer: coarse aggregate to ASTM C33/C33M, Size #5 and EPA 625-R-92-016.
- .5 Membrane barrier system (vapour barrier): to ASTM E1745, minimum 20 mil polyolefin-based resin sheet membrane. Refer to drawings / project specifications for vapour barrier systems.
- .6 Geotextile Fabric: Non-woven fiber construction with an apparent opening size of 0.15 mm.
 - .1 Unit weight 340 g/m² (ASTM D5261)
 - .2 Grab tensile strength 1100 N (ASTM D4632).
 - .3 Elongation from 45 to 105% (ASTM D4632).
 - .4 Trapezoid tear resistance 450 N (ASTM D4533).
 - .5 Puncture resistance 700 N (ASTM D4833).
 - .6 Mullen Burst 3600 Pa (ASTM D3786).

Part 3 Execution

3.1 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate.
- .2 Inform DCC Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install products according to manufacturers' requirements and as indicated on accepted Shop Drawings.
- .2 Connect each individual sub-slab area isolated by building footings, foundation walls or grade beams to installed radon roughed-in mitigation system. Use collection piping to draw radon gas from multiple sub-slab areas to single, capped extraction risers.
- .3 Prepare sub-grade surface prior to installation of geotextile fabric, and collection, extension and riser piping, to elevations indicated.
- .4 Install geotextile fabric on subsoil below gas permeable venting layer. to protect gas-venting layer from being contaminated with fines from subsoil.
- .5 Place geotextile fabric layer over entire sub-grade surface, with overlaps to manufacturer's requirements.
- .6 Install and seal floor drains, pits/cages, and collection/extension/riser pipes.
- .7 Confirm riser pipe penetration locations and sub-slab inlet location with the DCC Representative on site prior to installation.
- .8 Where piping is installed below a structural slab with void form:
 - .1 Install piping in accordance with section 22 05 02 – Plumbing and Drainage
 - .2 Maximum horizontal spacing between supports: in accordance with the National Plumbing Code of Canada (NPC) to suite the pipe material.
- .9 Install collection/extension/riser pipes.
- .10 Install single vertical riser pipe to minimum of 300 mm above finished floor slab.
- .11 Place collection pipes within gas permeable venting layer.
- .12 Solvent-weld pipe joints and fully insert into coupling or fitting to ensure joint integrity.
- .13 Ensure all piping is clearly labeled denoting its use. Refer to Section 23 05 53 - Identification for Mechanical Piping and Equipment for piping identification criteria.

- .14 Construct gas permeable venting layer by placing, grading, and compacting over entire sub-grade surface, geotextile layer, and collection/extension/riser piping.
- .15 Place membrane barrier system over gas permeable venting layer. Overlap and seal membrane to manufacturer's requirements and specifications.
- .16 Install and seal membrane barrier system around vertical penetrations with sufficient overlap and using air barrier membrane, sealant and construction tape or chemical welded seams to manufacturer's requirements and specifications.
- .17 Overlap and seal radon membrane barrier system at perimeters and floor slab penetrations to provide continuous seal of building area in contact with soil, to manufacturer requirements, system design, and requirements of this specification.
- .18 Install air barrier membrane as transition between radon membrane and upturn onto grade beams, foundation walls, footings, and items that penetrate finished floor slab. Design joints to accommodate anticipated movement.
- .19 Provide gas tight seals around surfaces of vertical penetrations. Prepare surfaces to manufacturer's requirements to facilitate membrane adherence. Use air barrier membrane, sealants, and construction tape as required to provide continuous seal between radon membrane and pipe, conduit, or other items that penetrate floor slab.
- .20 Terminate membrane with upturn at perimeter grade beams, foundation walls, footings, and strip footings, and terminate between beam, wall or footing and finished floor slab. Terminate membrane midway through floor slab and seal and secure using termination bar, mechanically fastened to beam or footing on 300 mm centers. Apply sealant to junction between membrane to footing, wall or beam, above termination bar.
- .21 Membrane seams: prepare, overlap, and seal to manufacturer's recommendations.
- .22 Avoid puncturing membrane excessively during floor slab construction. To limit membrane puncture during floor slab construction, design items such as rebar chair supports with wide base instead of legs to better spread rebar load.
- .23 Once concrete floor slab has cured sufficiently to allow work to proceed, clean joint surfaces in accordance with manufacturer's instructions and seal finished floor slab perimeter cold joints and other floor slab penetration junctions between dissimilar materials using high quality sealants appropriate to substrates. Test sealant to confirm adhesion with all surfaces prior to use. Design joints to accommodate anticipated movement.
- .24 Cap above-slab exposed open top of riser pipes and solvent weld to provide complete seal.

- .25 Label above-slab exposed riser pipe and cap to identify them as part of Radon Mitigation System. Where the riser pipe passes through above grade walls each portion of the wall (floor to floor) must receive labelling identifying the pipe as part of Radon Mitigation System.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16: Aggregates for Earthwork.
- .2 Section 31 23 33.01: Excavating, Trench and Backfilling.

1.2 REFERENCE STANDARDS

- .1 OPSS.MUNI 403 Nov 2023 – Construction Specification for Rock Excavation for Pipelines, Utilities, and Associated Structures in Open Cut.

1.3 DEFINITIONS

- .1 Rock: in accordance with Section 31 23 33.01 Excavation, Trenching and Backfilling.
- .2 Peak Particle Velocity (PPV): maximum speed or velocity reached by a particle in a medium, such as ground, as a result of seismic or vibrational event. It is used to quantify the intensity of ground motion caused by various sources, including earthquakes, explosions, construction activities, or industrial processes. PPV is measured in mm/s.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Comply with authority having jurisdiction requirements.
- .2 **Blasting is prohibited.**

1.5 ACTION AND INFORMATION SUBMITTALS

- .1 Include findings from review of existing conditions as specified in EXAMINATION in this Section.

1.6 SITE CONDITIONS

- .1 Existing conditions:
 - .1 The DCC Representative will visit adjacent property owners to determine existing conditions and describe the seismic recording operations.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not used

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions:

- .1 Verify substrate and project conditions in accordance with Section 01 71 00 – Examination and Preparation, and:
 - .1 Review existing conditions at the adjacent properties and nearby properties, that may be affected by mechanical/hydraulic hammering work, before starting work of this section. Review existing:
 - .1 Buildings;
 - .2 Structures; and
 - .3 Infrastructure.
 - .2 Photograph existing conditions.
 - .3 Describe buildings' and structures interiors and exteriors.
 - .4 Investigate foundations to determine if underpinning or shoring is required.
 - .5 Record and document findings.

3.2 ROCK REMOVAL – GENERAL

- .1 Rock excavation in accordance with OPSS.MUNI 403.
- .2 Remove rock to alignments, profiles, and cross sections indicated.
- .3 Excavate rock to produce uniform and stable excavation surfaces.
- .4 Excavate rock to form level bearing that follows natural strata. Form with sharp steps.
- .5 Prepare rock surface to be bond to concrete, by scaling, pressure-washing, and broom cleaning surfaces.
- .6 Excavate trenches to lines, widths, and grades as indicated.
- .7 Remove boulders and fragments which may slide or roll into excavated areas.
- .8 Minimize overbreak and avoid damage to adjacent structures.
- .9 Correct unauthorized rock removal in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

3.3 ROCK REMOVAL – MECHANICAL

- .1 Excavate rock using mechanical methods.
- .2 Removal final layers carefully to provide sound and unshattered base for footings and foundations.

3.4 CLEANING

.1 Salvaged Rock:

- .1 Stockpile suitable rock where instructed by the DCC Representative and in accordance with Section 31 05 16 – Aggregates for Earthwork.
- .2 Maintain stockpile site in tidy, well-drained condition, free of standing surface water.
- .3 Protect stockpiled rock from contamination.
- .4 Rock removed that cannot be used as backfill material due to size constraints stated in Section 31 05 16 – Aggregates for Earthwork and Section 31 23 33.01 – Excavating, Trenching and Backfilling shall be hauled and disposed offsite at no additional cost to the contract.

.2 Rock Disposal:

- .1 Dispose of removed rock offsite.
- .2 Do not dispose removed rock into landfill. Send material to appropriate quarry acceptable to the DCC Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00: Submittal Procedures.
- .2 Section 01 35 43: Environmental Procedure.
- .3 Section 01 35 43.01: Environmental Protection – Soil Management.
- .4 Section 01 45 00: Quality Control.
- .5 Section 31 00 00.01: Earth Work – Short Form.
- .6 Section 31 05 16: Aggregates for Earthwork.
- .7 Section 32 11 23: Aggregate Materials.
- .8 Section 33 14 16: Site Water Utility Distribution Piping.
- .9 Section 33 31 11: Sanitary Sewage Gravity Piping.
- .10 Section 33 41 00: Storm Utility Drainage Piping.

1.2 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.MUNI 401 Nov. 2021 - Construction Specification for Trenching, Backfilling, and Compacting.
 - .2 OPSS.MUNI 1010 Nov. 2013 - Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
- .2 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.
- .3 ASTM International (ASTM)
 - .1 ASTM D 698-12R21, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .2 ASTM D422-63e2, Standard Test Methods for Particle Size Analysis of Soils.

1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

- .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m³ which cannot be removed by means of heavy-duty mechanical excavating equipment with 0.95 to 1.15 m³ 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. This includes concrete, pavement, and grassed areas.
- .2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding. The material to be 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.
- .3 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
- .5 Unsuitable materials:
 - .1 Weak and compressible materials under excavated areas.
 - .2 Frost susceptible materials under excavated areas:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, gradation within limits specified when tested to ASTM D422.
 - .2 Table

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 – 100
0.02 mm	10 – 80
0.005 mm	0 - 45
 - .3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .6 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.
- .7 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

1.4 ACTION AND INFORMATION SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittals Procedures.
- .2 Quality Control in accordance with Section 01 45 00 – Quality Control.
- .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: clearance record from utility authority.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Inform DCC Representative at least 4 weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.

1.5 PROTECTION OF EXISTING FEATURES

- .1 Existing buried utilities and structures:
 - .1 Before commencing work establish location of buried services on and adjacent to site.
 - .2 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .4 Before beginning excavation work, notify applicable owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
 - .1 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.
 - .5 Confirm locations of buried utilities by careful test excavations or soil hydrovac.
 - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .7 Where utility lines or structures exist in area of excavation, obtain direction of DCC Representative before removing, re-routing.
 - .8 Record location of maintained, re-routed and abandoned underground lines.
 - .9 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 to approval of DCC Representative.
- .3 Where required for excavation, cut roots or branches as approved by DCC Representative.

1.6 SUPPORT OF EXCAVATION

- .1 Suitably slope or properly shore sides of excavations according to site conditions, all in accordance with Ontario Health and Safety Act.
- .2 The choice of any method of support will be the responsibility of the Contractor. However, drawings and calculations for the method of support selected, designed by a qualified professional engineer in accordance with the Provincial safety requirements, are to be submitted to DCC Representative for review before its use.
- .3 If it is desirable that any support, other than that which may be shown on the Drawings, be left in the excavations, then DDC Representative will issue instructions accordingly.
- .4 Take every precaution against slips or falls, but if any should occur, at once make good the same. If any such slip or fall affects or may affect the stability of the permanent work, execute such remedial work as necessary, including filling up of any space left by the slop or fall with approved granular material. Submit proposed remedial work to the DCC Representative for review.

1.7 EXCAVATION AND BACKFILLING REQUIRED BY OTHER SECTIONS

- .1 Excavation and backfilling for site services is included in this Section and shall be carried out in accordance with provisions specified herein and as indicated on drawings. This work to be laid out and supervised by trade concerned.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Type 1 fill: to OPSS.MUNI 1010, Table 2 for Granular 'A' aggregate. Maximum size 26.5 mm
- .2 Type 2 fill: to OPSS.MUNI 1010, Table 2 for Granular 'B' Type 2 aggregate. Maximum size 106 mm.
- .3 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.

.4 Unshrinkable fill to OPSS 578, OPSS 1359, proportioned and mixed to provide:

- .1 Maximum compressive strength of 0.4 MPa at 28 days.
- .2 Maximum Portland cement content of 25 kg/m³.
- .3 Minimum strength of 0.07 MPa at 24 h.
- .4 Concrete aggregates: to CSA A23.1/A23.2.
- .5 Slump: 160 to 200 mm.

.5 Tarpaulin

- .1 Polyethylene 3 oz / 6 mil, solid or woven fabric.
 - .1 Seams:
 - .1 Overlapped: 300 mm.
 - .2 Welded: 50 mm.

Part 3 EXECUTION

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with 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 indicated and/or directed by DCC Representative after area has been cleared of brush and grasses and removed from site.
- .2 Strip topsoil to depths as required to undertake the work.
 - .1 Do not mix topsoil with subsoil.

- .3 Stockpile in locations as required to or directed by DCC Representative for reuse.

- .1 Stockpile height not to exceed 2 m and should be protected from erosion.

- .4 Dispose of unused topsoil offsite as directed by DCC Representative.

3.4 STOCKPILING

- .1 Stockpiling procedures shall be in accordance with Section 01 35 43.01 – Subsection .5 and .6.

- .2 Stockpile fill materials in areas designated by DCC Representative.

- .1 Stockpile granular materials in manner to prevent segregation. Cover with tarpaulin.

- .2 Temporary stockpiled materials to be at least 30 m from sensitive receptors (e.g., waterbodies) and property boundaries.

- .3 Protect fill materials from contamination.

- .4 Do not stockpile materials in drainage pathways.

- .5 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

- .6 Inspect and maintain stockpiled materials on a regular schedule, as per the Soil Management Plan.

- .7 Water contained in the stockpiled materials to be properly contained and managed to prevent contaminated water from running off into the environment.

3.5 TEMPORARY SOIL COVERS

- .1 Cover all stockpiles.

- .1 All temporary stockpiled soil must be placed on an impermeable surface and covered with an impermeable, properly secured tarp.

- .2 Pin down tarpaulins to prevent uplift by wind.

- .3 Inspect tarpaulins prior to any forecast rain event.

3.6 SHORING, BRACING AND UNDERPINNING

- .1 Maintain side and slopes of excavations in safe conditions by appropriate methods and in accordance with Occupational Health and Safety Act.

- .1 Where conditions are unstable, DCC Representative to verify and advise mitigating procedures.

- .2 Construct temporary works to depths, heights and locations as approved by DCC Representative.

3.7 DEWATERING AND HEAVE PREVENTION

- .1 Dewatering in accordance with OPSS 517.
- .2 Keep excavations free of water while work is in progress.
- .3 Provide for DCC Representative's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.
- .4 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.
- .5 Protect open excavations against flooding and damage due to surface run-off.
- .6 Dispose of water in accordance with Section 01 35 43 – Environmental Procedures and in manner not detrimental to public and private property, or any portion of work completed or under construction.
- .7 Discharge only clean water (<25 mg/L T.S.S) to sewers. Sediment laden water must be treated to reduce T.S.S to <25 mg/L.

3.8 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions indicated or as directed by DCC Representative.
- .2 Remove concrete, masonry, paving, walks and other obstructions encountered during excavation.
- .3 Excavations must not interfere with bearing capacity of adjacent foundations.
- .4 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 For trench excavation:
 - .1 Unless otherwise authorized by DCC Representative in writing, excavate trenches so pipe can be laid to the alignment and depth required. Excavations length to be not more than pipe length that can be laid and backfilled in one day. Brace and drain trench so workers may work safely and efficiently.
 - .2 Trenches for pipping, and related excavations must be of sufficient width and depth at all points to allow pipes to be laid, joints to be formed, and appurtenant structures to be built in a workmanlike manner, and when

- need, to allow for sheeting and shoring, pumping, draining, and for removing and replacing all materials unsuitable for foundations.
- .3 Remove organic material and soft deposits to a depth where medium dense to dense materials are encountered as designated by DCC Representative.
 - .4 Do not stockpile excavated materials alongside trench if the bearing soil will cause trench side failure or bottom uplift and affect pipe alignment.
 - .7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by DCC Representative.
 - .1 Stockpile suitable excavated materials required for backfill in approved location.
 - .2 Do not stockpile materials along side of excavations in such a manner that stock piling will cause side failure.
 - .8 Restrict vehicle operations directly adjacent to open trenches.
 - .9 Dispose of surplus and unsuitable excavated material in approved location off site.
 - .10 Do not obstruct flow of surface drainage or natural watercourses.
 - .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
 - .12 Notify DCC Representative when bottom of excavation is reached.
 - .13 Obtain DCC Representative's approval of completed excavation.
 - .14 Remove unsuitable material from trench bottom to extent and depth as directed by DCC Representative.
 - .15 Correct unauthorized over-excavation as follows:
 - .1 Fill under other areas with Granular 'B' Type 2 material compacted to not less than 95% of corrected Standard Proctor maximum dry Density and in accordance to ASTM D698.
 - .16 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of DCC Representative.

3.9 FILL TYPES AND COMPACTION

- .1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from corrected Standard Proctor maximum dry density.
 - .1 Suitable Native Material.

- .2 Place unshrinkable fill in areas as indicated.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Prior to placing granular material for bedding, grade surface to within 40 mm of elevations and cross sections indicated but not uniformly high or low. Compact to 100% Standard Protector maximum dry density.
- .2 Place granular material for bedding in uniform layers not exceeding 150 mm to thickness indicated. Grade intermediate granular courses to within 30 mm of elevations and cross-sections indicated, but not uniformly high or low.
- .3 Place and compact granular material for bedding and surround of underground services as indicated below:
 - .1 Granular 'A' Material.
- .4 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

- .1 Do not proceed with backfilling operations until DCC Representative has inspected and approved installations.
- .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 subgrade elevation or top of trench. Compact each layer before placing succeeding layer.
- .5 Backfill around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 h after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed work to equalize loading.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from DCC Representative.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.

3.12 RESTORATION

- .1 Upon completion of work, remove waste and surplus materials and debris, trim slopes, and correct defects as directed by DCC Representative.
- .2 Replace topsoil as required.
- .3 Reinstate finished surface (grass, pavement, sidewalks) to elevation which existed before excavation.
- .4 Clean and reinstate areas affected by work as directed by DCC Representative.
- .5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 h.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash and debris.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 43.01: Environmental Protection – Soil Management.
- .2 Section 31 05 16: Aggregates for Earthwork.
- .3 Section 31 23 33.01: Excavating, Trenching and Backfilling.

1.2 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.MUNI 1010 Nov. 2013 - Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
 - .2 OPSS.MUNI 1860 Nov. 2018 - Geotextiles
- .2 ASTM D 698-12R21, July 2021 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 31 05 16 – Aggregates for Earthwork.
- .2 Store materials in dry conditions, clean and well-ventilated area.
- .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Material in accordance with Section 31 05 16 – Aggregates for Earthwork and Section 01 35 43.01 – Environmental Protection – Soil Management.
- .2 Granular 'A': to OPSS.MUNI 1010. Maximum size Granular 'A' 26.5 mm. Depths as indicated.
 - .1 Iron blast furnace slag or nickel slag is not acceptable.
- .3 Granular 'B' Type II: to OPSS.MUNI 1010. Maximum size Granular 'B' Type II 106.0 mm. Depths as indicated.

- .1 Iron blast furnace slag or nickel slag is not acceptable.
- .4 Woven Geotextiles Class I: to OPSS.MUNI 1860. Material Specifications for Geotextiles.

Table 1: Physical Property Requirements for Woven and Non-Woven Geotextiles

Property	Test Method	Unit	Geotextile: Class I, Woven
			BNQ Product Designation: OPSS 1860-I-W
Tensile strength, MARV, minimum	ASTM D 4632/D 4632 M	N	800
Tear strength, MARV, minimum	ASTM D 4533/D 4533 M	N	300
Puncture strength, MARV, minimum	ASTM D 6241	N	1650
Permittivity, minimum	ASTM D 4491/D 4491 M, Method A	s ⁻¹	0.005
Filtration opening size (FOS)	CAN/CGSB 148.1, Method No. 10	μ	As specified in the Contract Documents
Ultraviolet stability, minimum	ASTM D 4355	%	50% retained tensile strength at 500 hours

*Note: A Class II Woven geotextile may be used to replace a Class I Woven geotextile or a Class II Non-Woven geotextile may be used to replace a Class I Non-Woven geotextile, as long as the geotextile being proposed for use meets the requirements for Filtration Opening Space, according to CAN/CGSB 148.1, Method No. 10, as specified in the Contract Documents.

Part 3 EXECUTION

3.1 PREPARATION

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

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular sub-base after subgrade surface is inspected and approved in writing by DCC Representative.
- .2 Place granular base after sub-base surface is inspected and approved in writing by DCC Representative.
- .3 Placing:
 - .1 Construct aggregates to depth and grade in areas indicated.

- .2 Ensure no frozen material is placed.
- .3 Place material only on clean unfrozen, properly shaped and compacted and free from snow and ice.
- .4 Place material using methods which do not lead to segregation or degradation of aggregate.
- .5 Place material to full width in uniform layers not exceeding 150 mm when compacted.
- .6 Spread each layer uniformly using approved grading equipment and methods.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace that portion of layer in which material becomes segregated during spreading.

3.3 COMPACTION EQUIPMENT

- .1 Ensure compaction equipment is capable of obtaining required material densities.

3.4 COMPACTING

- .1 Compact each layer to density not less than 100% Standard Proctor maximum dry density to ASTM D698.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted layer.
- .3 Add water as required to maintain material at or near optimum moisture content while compacting and obtain specified density.
- .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by DCC Representative.
- .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 PROOF ROLLING

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with center to center spacing of 730 mm.
- .2 Obtain written approval from DCC Representative to use no standard proof rolling equipment.
- .3 Proof roll at level in granular base as indicated.

- .1 If use of non-standard proof rolling equipment is approved, DCC Representative to determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by DCC Representative.
 - .2 Backfill excavated subgrade with common material and compact in accordance with Section 30 00 00.01 Earthwork.
 - .3 Replace sub-base material and compact in accordance with this Section.
 - .4 Replace base material and compact in accordance with this Section.
- .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by DCC Representative and replace with new materials in accordance with Section 31 05 16 – Aggregates for Earthwork and this Section at no extra cost.

3.6 SITE TOLERANCES

- .1 Finish compacted surface to within 12 mm of established grade as indicated by a 3 m straightedge placed in any direction.
- .2 Correct irregularities greater than 12 mm by loosening the surface and adding or removing material until surface is within specified tolerance.

3.7 FIELD QUALITY CONTROL

- .1 DCC Representative may perform field and laboratory tests for control of moisture, density and aggregate gradation. Results will control Contractor's operations.

3.8 CLEANING

- .1 Leave work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish tools and equipment in accordance with Section 01 74 00.

3.9 PROTECTION

- .1 Maintain finished base, sub-base in condition conforming to this Section until succeeding material is applied or until acceptance by DCC Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16: Aggregates for Earthwork.
- .2 Section 31 23 33.01: Excavating, Trenching and Backfilling.
- .3 Section 32 11 23: Aggregate Materials.

1.2 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.MUNI 1010 Nov 2013 - Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
 - .2 OPSS.MUNI 1101 Nov 1101 – Material Specification for Performance Graded Asphalt Cement.
 - .3 OPSS.MUNI 1103 Nov 2019- Material Specification for Emulsified Asphalt.
 - .4 OPSS.MUNI 1150 Nov 2020 – Material Specification for Hot Mix Asphalt.
 - .5 OPSS.PROV 313 Apr 2021 - Construction Specification for Hot Mix Asphalt End Result.

1.3 SAMPLES

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples:
 - .1 Inform DCC Representative of proposed source of aggregates and provide access for sampling 4 weeks prior to beginning work.
 - .2 Submit asphalt concrete mix design and trial mix test results to DCC Representative for review at least 4 weeks prior to beginning work.
 - .3 Upon request, submit manufacturer's test data and certification that asphalt cement meets requirements of this section.

1.4 PROTECTION

- .1 Protect buildings, landscaping, roads, driveways, sidewalks, trees and shrubs on site and adjacent property that may be damaged by paving machinery, equipment or personnel. Make good property damaged due to paving operations.
- .2 Take necessary precautions to protect workmen and public from hazards of paving operations.
- .3 Keep vehicular traffic off newly paved areas until paving properly cured.

- .4 Provide access to building and structures at all times. Arrange paving schedule so as not to interfere with normal use of premises.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Asphalt surface course: to OPSS.MUNI 1150 Nov 2020, Type HL 3, depth as indicated.
- .1 HL 3: a dense-graded surface course mix with maximum aggregate size of 16 mm.
- .2 Reclaimed Asphalt Pavement: up to 15% by mass of RAP is permitted for HL 3 surface course mixes.
- .3 Asphalt Cement Content: % Asphalt Cement Content, minimum by mass of mixture = 5.0.
- .2 Asphalt binder course: to OPSS.MUNI 1150 Nov 2020, Type HL 8, depth as indicated.
- .1 HL 8: a coarse-graded binder course mix with maximum aggregate size of 26.5mm.
- .2 Reclaimed Asphalt Pavement: up to 30% by mass of RAP is permitted for HL 8 binder mixes.
- .3 Asphalt Cement Content: % Asphalt Cement Content, minimum by mass of mixture = 4.7.
- .3 Performance Graded Asphalt Cement (PGAC): to OPSS.MUNI 1101 Nov 2016.
- .1 Grade Selection for Ontario:
- | Zone | Zone Description | PGAC |
|--------|---|---------|
| Zone 1 | The area north of the boundary formed by the French River, Lake Nipissing, and the Mattawa River | 52 – 34 |
| Zone 2 | The area south of Zone 1, and north of a line from Honer Harbour, to Longford, Taylor Corners, Cavan, Campbellford, and Mallorytown | 58 – 34 |
| Zone 3 | The area south of Zone 2 | 58 - 28 |
- .2 Grade Selection for Hot Mix Asphalt Incorporating RAP:
- | Level | RAP Content | Recommended New PGAC Grade |
|---------|-----------------------|--|
| Level 1 | Equal to or below 20% | Use the same PGAC grade as for a new mix; based on location zone and traffic level |
| Level 2 | 21 to 40% | Reduce both the low and high temperature grades by one grade (e.g., if PG 58-28 would normally be used, select a PG 52-34) |
- .4 Primer: emulsified asphalt to OPSS.MUNI 1103 Nov 2019, rapid setting type.
- .5 Granular base: to OPSS.MUNI 1010 Nov 2013, Granular 'A'. Maximum size 26.5 mm.

- .6 Granular sub-base: to OPSS.MUNI 1010 Nov 2013, Granular 'B' Type II. Maximum size 106 mm.

Part 3 EXECUTION

3.1 GENERAL

- .1 Use workers skilled in placing asphalt concrete.

3.2 FINE GRADING

- .1 Fine grade granular base to within 12 mm of elevations and cross sections indicated immediately prior to placement of asphalt materials. Add or remove granular base as required. Compact to 100% Standard Proctor Maximum Dry Density or as directed by DCC Representative.

3.3 ADJUSTING TOPS OF CASTINGS

- .1 Prior to placing asphalt:
 - .1 Adjust manhole covers and catch basin frames to match asphalt surface, using manufactured or cast-in-place grade rings.
 - .2 Adjust valve boxes to finished asphalt surface. Raise or lower top sections of valve boxes.

3.4 CLEANING

- .1 Remove dust, contaminants, loose and foreign materials, oil and grease in designated areas.
- .2 Use rotary power brooms supplemented by hand brooming as required.
- .3 Where directed, remove to existing pavement level, sealing compound which has protruded excessively and dispose of removed material as directed.
- .4 Keep drainage system clear of loose and waste materials.

3.5 EXCAVATING

- .1 Excavate to elevations and dimensions indicated or required for construction of work.
- .2 Make excavation to clean lines to minimize quantity of fill material required.
- .3 Earth bottoms of excavations to be dry undisturbed soil, reasonably level, free from loose or organic matter.

3.6 INSPECTION

- .1 Check graded subgrade for conformity with existing conditions before placing granular sub-base and granular base material.
- .2 Proof-roll subgrade, sub-base and base surface with mass and type of roller approved by DCC Representative.
 - .1 Check for unstable areas.
 - .2 Check for areas requiring additional compaction.
- .3 Notify DCC Representative of unsatisfactory conditions.
- .4 Do not begin paving work until such conditions have been corrected and are ready to receive paving.
- .5 When complete, have DCC Representative inspect excavations to verify soil bearing capacity, depths and dimensions.
- .6 Excavation, beyond limits shown on drawings, if authorized in writing by DCC Representative, will be paid for as extra to Contract Amount in accordance with General Conditions. Quantities will be calculated in place, compaction included. Truck load measurements not acceptable.
- .7 Correct unauthorized excavation at no extra cost by filling with Granular A material and compacting to minimum 100% ASTM D698 Proctor Compaction Density.

3.7 GRANULAR SUB- AND GRANULAR BASE

- .1 Granular B Type II (Sub-base): thickness as indicated.
- .2 Granular A (base): thickness as indicated.
- .3 Place in layers not exceeding 150 mm compacted thickness. Compact each layer to 100% Standard Proctor Maximum Dry Density.

3.8 ASPHALT COURSE

- .1 Complete work in accordance with OPSS.PROV 313 Apr 2021.

3.9 PAVING

- .1 Obtain DCC Representative approval of granular base prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades, and lines as indicated or as directed by DCC Representative.
- .3 Placing Conditions:
 - .1 Binder course shall not be placed unless the ambient air temperature is at least 2°C.

- .2 Surface course shall not be placed unless the ambient air temperature is at least 7°C.
- .4 Do not place asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .5 Place, roll and compact asphalt in accordance with OPSS 313 Apr 2021.

3.10 JOINTS

- .1 Cut back bituminous course to full depth in straight or curved lines as required to expose fresh vertical surfaces. Remove any broken or loose material.
- .2 Paint exposed edge of asphaltic joints, edges of manholes and catch basin frames, curbs and similar items with asphalt primer prior to placing asphalt courses.
- .3 Where paving comprises two courses overlap longitudinal joints not less than 600 mm.
- .4 Carefully place and compact hot asphaltic material against joints.

3.11 FINISH TOLERANCES

- .1 Finish asphalt surface to within:
 - .1 6 mm for all binder courses, leveling courses, and padding as indicated by a 3 m straight edge placed in any direction.
 - .2 3 mm for all surface courses as indicated by a 3 m straight edge placed in any direction.

3.12 DEFECTIVE WORK

- .1 Repair areas showing checking, rippling, or segregation.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 This Section specifies requirements to provide and maintain erosion and sedimentation control features where required, prior and during construction.

1.2 RELATED REQUIREMENTS

- .1 Section 31 23 33.01: Excavating, Trenching and Backfilling.

1.3 REFERENCE STANDARDS

- .1 OPSS.MUNI 1860 Nov. 2018 – Material Specification for Geotextile.
.2 OPSD 219.110 Nov 2021 – Light-Duty, Silt Fence Barrier.
.3 OPSD 219.180 Nov 2021 – Straw Bale Flow Check Dam.

1.4 SUBMITTALS

- .1 Product Data: provide data indicating material characteristics, performance criteria, limitations.

Part 2 PRODUCTS

2.1 SEDIMENT CONTROL FENCE

- .1 Preassembled silt fence with industrial woven geotextile fabric, pre-stapled to wood posts spaced as indicated.

2.2 GEOTEXTILE

- .1 Physical Property Requirements for Temporary Silt Fence Geotextiles:

Property	Test Method	Unit	Supported Silt Fence	Unsupported Silt Fence	
				Woven	Non-Woven
Maximum post spacing	-	m	1.2	2.0	1.2
Tensile strength, MARV, minimum	ASTM D 4632/D 4632M	N	400	500	

Permittivity, minimum	ASTM D 4491/D 4491M	s ⁻¹	0.05
Filtration Opening Size	CAN/CGSB 148.1, Method No. 10	µm	20 – 30
Ultraviolet stability, minimum	ASTM D 4355/D 4355M	%	70% retained tensile strength at 500 hours

2.3 TARP (TARPAULIN)

- .1 In accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

Part 3 EXECUTION

3.1 GENERAL INSTLLATION

- .1 Maintain the site in a clean and safe manner in order to minimize erosion and sediment movement.

3.2 SEDIMENT CONTROL FENCE

- .1 Install sediment control fence where required.
- .2 Excavate 200 mm x 200 mm trench along length of fence as indicated. Lay fabric bottom in trench and backfill.

3.3 TEMPORARY SOIL COVERS

- .1 Where tarps are to be used, ensure tarps are pinned down to prevent uplift by wind.
- .2 Inspect tarps prior to any forecast rain event.

3.4 STARW BALE CHECK DAM

- .1 Install straw bale check dam where required.
 - .1 Number of bales to vary to suit ditch.
 - .2 Bale ties shall not be in contact with ground.
 - .3 Stakes to be equally spaced.
 - .4 Bottom of end bales of downstream row shall be higher than the low point of flow check.
- .2 Straw bales to be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.

- .3 Fill and compact gaps with loose straw.

3.5 MAINTENANCE

- .1 Maintain sedimentation control features throughout the construction period.
Repair damage to original condition.
- .2 Remove accumulated sediment from sediment control features when and as directed by DCC Representative.
 - .1 The contractor shall remove the sediment deposits at erosion control structures prior to the level of sedimentation reaching a point within 100 mm above design surface.
- .3 Maintain vertical alignment of sediment control fence such that it is always plumb and straight.
- .4 Remove sedimentation control features when directed by DCC Representative.
Take care to avoid causing turbidity and excessive re-suspension of particles when removing sediment control features.
- .5 Dispose of the excavated sediment offsite.

3.6 REMOVAL

- .1 Do not remove any erosion control structure without authorization of the DCC Representative.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 This section specifies requirements for constructing walks, ramps, curbs and gutters. Work includes fine grading; supply, placing and finishing of Portland Cement concrete and asphalt concrete; and backfilling. This section also specifies the requirement for cast-in-place tactile warning surfaces.

1.2 RELATED REQUIREMENTS

- .1 Section 31 23 33.01: Excavating, Trenching and Backfilling.
- .2 Section 32 11 23: Aggregate Materials.
- .3 Section 32 12 16: Asphalt Paving.
- .4 Section 32 98 00: Reinstatement.

1.3 REFERENCE STANDARDS

- .1 ASTM International.
 - .1 ASTM C157 / C157M 08(2014)e1 – Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
 - .2 ASTM C260 / C260M – 10a – Standard Specification for Air-Entraining Admixtures for Concrete.
 - .3 ASTM C457 / C457M – 12 – Standard Test Method for Microscopical Determination of Parameters of the Air Void System in Hardened Concrete.
 - .4 ASTM C494 / C494M – 13 – Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C1017 / C1017M – 13e1 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM C1202 – 12 – Standard Test Method for Electrical Indication of Concretes Ability to Resist Chloride Ion Penetration.
- .2 CSA Group
 - .1 CSA-A23.1-24/A23.2-24, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA B651-2022 Accessible Design for the Built Environment.
- .3 Ontario Provincial Standard Specifications
 - .1 OPSS.MUNI 351 Nov 2021 – Concrete Sidewalk.
 - .2 OPSS.MUNI 353 Nov 2021 – Concrete Curb and Gutter Systems.
 - .3 OPSS.MUNI 1350 Nov 2023 – Concrete – Materials and Production

- .4 Ontario Provincial Standard Drawings
 - .1 OPSD 310.010 – Concrete Sidewalk.
 - .2 OPSD 310.020 – Concrete Sidewalk Adjacent to Curb and gutter.
 - .3 OPSD 310.039 – Concrete Sidewalk Ramps, Tactile Walking Surface Indicators, Component.
 - .4 OPSD 600.010 – Concrete Barrier Curb with Wide Gutter.
 - .5 OPSD 600.040 – Concrete Barrier Curb with Standard Gutter.
 - .6 OPSD 600.110 – Concrete Barrier Curb.
 - .7 OPSD 603.020 – Precast Concrete Curb.
- .5 Ready Mixed Concrete Association of Ontario Publication (RMCAO)
 - .1 R1025 – Certificate of Ready Mixed Concrete Production Facilities.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform DCC Representative of proposed source of materials and provide access for sampling minimum 4 weeks prior to commencing work.
- .3 If materials have been tested by accredited testing laboratory testing laboratory approved by DCC Representative 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.

1.5 PROTECTION

- .1 Provide protection, including security, if necessary, to prevent damage to newly installed walks, curbs and gutters.
- .2 Keep sufficient covering on site to protect fresh concrete from damage by weather.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with OPSS 1350, with a minimum specified 28-Day compressive strength of 32 MPa, Class C-2 Exposure.
 - .1 Sidewalk thickness: 125 mm.
 - .1 At residential driveways and adjacent to curb: 150 mm.
 - .2 At commercial and industrial driveways: 200 mm.
 - .2 Sidewalk width: as indicated.
 - .3 Barrier curb: as indicated.
 - .4 Barrier curb and gutter: as indicated.

- .2 Expansion Joint Material
 - .1 Sidewalk: expansion joint filler material to be asphalt impregnated fibreboard having a minimum of 12mm thickness in accordance with OPSS 1308, Type A.
 - .2 Curbs: expansion joint filler material to be in accordance with OPSS 1308 Type A.
 - .1 Granulated cork fillers are not acceptable.
- .3 Curing Compound: in accordance with OPSS 1315.
- .4 Forms: in accordance with OPSS 919.
- .5 Granular base: material to Section 32 11 23 - Aggregate Materials
- .6 Tactile Walking Surface Indicators: in accordance with OPSS 351.
 - .1 Cast iron in accordance with ASTM A48M, Class 35B and shall be bare and not coated with paint or other coatings or substances.
 - .2 Truncated domes to CSA B651.

Part 3 EXECUTION

3.1 GRADE PREPERATION

- .1 Fine grade gravel surface prior to placing Portland cement concrete.

3.2 ADJUSTING TOPS OF CASTINGS

- .1 Adjust casting to match finished surface prior to placing Portland cement concrete.

3.3 CONCRETE

- .1 Obtain DCC Representative's approval of granular base prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Place concrete in continuous operation beginning at lowest point. Tamp or vibrate to prevent honeycombing.
- .4 Contraction joint to be minimum of one quarter of section thickness.
- .5 Space contraction joints at a maximum of 4.5 meters spacing, unless otherwise indicated. Match joints in abutting curb and walk to extent practical.
- .6 Expansion joints to be filled full depth with 12 mm thick asphalt impregnated fibreboard joint filler material and shall be clean and dry at the time of construction.

- .1 At the end of each day's work, or in the event of an unavoidable stoppage of concrete placement extending more than 45 minutes, an expansion joint shall be constructed at the planned location of a joint.
- .7 Isolation joints to be constructed full depth where the sidewalk abuts a rigid object or changes directions.
- .8 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom side to side across sidewalk.
 - .1 Broom all exposed concrete surfaces to provide evenly textured, non-skid surface.
 - .2 Apply curing compound in accordance with OPSS 1315.
- .9 Do not apply water to newly placed concrete surfaces.
- .10 Finish perimeter of all slabs with an edger.
 - .1 Provide edging with 5 mm radius edging tool.
- .11 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.
- .12 Form stripping:
 - .1 Strip forms only when concrete has developed sufficient strength to resist damage to corners and edges.

3.4 TOLERANCES

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5 TACTILE WALKING SURFACE INDICATORS

- .1 Install tactile walking surface indicators at curb ramp edges as indicated and in accordance with local municipal by-laws.
- .2 Plates to be cleaned after installation.

3.6 CURING

- .1 Concrete curing to be in accordance to OPSS 904.
- .2 Curing period to be a minimum of 7 days for concrete subject to cold weather and concrete cured with curing compound.

3.7 BACKFILL

- .1 Backfill when Portland cement concrete have strength sufficient to resist damage from backfilling operations.

- .2 Do backfilling in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

3.8 CLEANING

- .1 Final cleaning: Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment in accordance with 01 74 00 – Cleaning.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 This section covers the requirements for the application of pavement markings onto bituminous or concrete pavement.

1.2 RELATED REQUIREMENTS

- .1 Section 31 12 16: Asphalt Paving.

1.3 REFERENCES

- .1 OPSS.MUNI 710 Nov 2021 – Construction Specification for Pavement Markings.
- .2 OPSS.MUNI 1712 Nov 2021 – Organic Solvent Based Traffic Paint.
- .3 Manual of Uniform Traffic Control Devices for Ontario, MUTCD.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedure.
- .2 Product data:
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include project characteristics, performance criteria, physical size, finish and limitations to DCC Representative.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Paint: traffic paint to OPSS.MUNI 1712.
- .2 Colour:
 - .1 White – CGSB 1-GP-12 white 513-301
 - .2 Yellow – shall match either the yellow traffic paint chip of the Ministry of Transportation, Ontario or U.S. FED-STD-595B, Yellow 33538
- .3 Thinner: to CAN/CGSB-1.5.

Part 3 EXECUTION

3.1 EQUIPMENT

- .1 Paint applicator to be an approved pressure type distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 CONFITION OF SURFACES

- .1 Pavement surface to be dry, free from ponded dust, oil, water, frost, ice, grease, and other foreign materials.

3.3 TRAFFIC CONTROL

- .1 Provide traffic control and barriers to protect freshly painted areas.

3.4 APPLICATION

- .1 Lay out pavement markings to the approval of DCC Representative.
- .2 Unless otherwise approved by DCC Representative, apply paint only when air temperature is above 10 °C, wind speed is less than 60 km/h and no rain is forecast within next 4 h.
- .3 Apply traffic paint event evenly at rate of 150 sf/gallon.
- .4 Do not thin paint.
- .5 Symbols and letters to conform to local standards.
- .6 Paint lines to be of uniform colour and density with sharp edges, minimum 100 wide.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.

3.5 TOLERANCE

- .1 Paint markings to be within plus or minus 13 mm of dimensions indicated.
- .2 Remove incorrect marking using mechanical methods as directed by DCC Representative. Blacking out will not be permitted.

3.6 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 This section specifies requirements for preparation of subgrade, provision, placement, and fine grading of topsoil for sodded lawn areas. Work includes supply and placement of materials, complete with all related components and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 32 92 23: Sodding.
- .2 Section 32 92 19.16: Hydraulic Seeding.

1.3 REFERENCE STANDARDS

- .1 OPSS.MUNI 802 Nov 2019 – Construction Specification for Topsoil.
- .2 ASTM D2974-14 Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
- .3 ASTM D4972-13 pH of Soils.
- .4 Landscape Ontario Horticultural Trades Association 2004 (LOHTA 2004). Landscape Guidelines, 2004 Edition – Chapter 5 – Topsoil Guidelines.

1.4 SOURCE QUALITY CONTROL

- .1 Inform the DCC Representative of proposed source of topsoil to be supplied and provide access for sampling.
- .2 Arrange to have testing of topsoil. Testing to be carried out by N.S. Dept. of Agriculture laboratory or another approved laboratory.
- .3 Test topsoil from source prior to stripping and stockpiling for clay, sand and silt, coarse fragments, particle size, nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg) and organic matter.
- .4 Perform pH test to determine acidity of alkalinity and required treatment to bring pH value of soil to pH value of surrounding soil. Test stockpiled soil after it has been spread in place.
- .5 Submit two copies of soil analysis and recommendations for corrections to the DCC Representative.
- .6 Implement recommendations.

1.5 DELIVERY, STORAGE AND PROTECTION

- .1 Schedule deliveries to minimize storage at job site without causing delays.
- .2 Protect newly graded and filled areas from washouts and settlements caused by rain and water damage. Fill and grade settled or washed-out areas to required levels and slopes.

1.6 SCHEDULING

- .1 Schedule topsoiling and finish grading operations to coincide with sodding operations.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Topsoil test analysis report to be submitted two (2) weeks prior to the start of topsoil placement. Placement cannot begin until analysis is approved.
- .2 Submit soil test analysis report for approval for each source of topsoil and growing medium from an approved soil-testing laboratory, as below:
 - .1 Use testing laboratory approved by the DCC Representative. All soil and growing medium tests to be as per ASTM D5268.
 - .2 Chemical analysis including the following:
 - .1 pH
 - .2 Nutrient levels by parts per million including: Phosphorus, Potassium, Magnesium, Calcium.
 - .3 Soluble salt by electrical conductivity of a 1:2 soil water sample measured in mmhos/cm.
 - .4 Percent Organic Matter by dry weight as determined by ignition (Ash Burn Test or Walkley/Black Test, ASTM F1647)
 - .5 Carbon to Nitrogen (C:N) ration.
 - .3 Report suitability of topsoil or growing medium for growth of applicable planting material. Soil analysis tests to include recommendations for normal acceptable ranges of soil chemical attributes for the type of plants included in the project in the same units as the test data.
- .3 Mechanical analysis of topsoil and amendments per Landscape Ontario Horticultural Trades Association – Landscape Guidelines.
- .4 Nutrient test to include the testing laboratory recommendations for supplemental additions to the growing medium.
- .5 Contractor to arrange for testing at the start of the project.

Part 2 PRODUCTS

2.1 TOPSOIL

- .1 Topsoil to be in accordance with the OPSS.MUNI 802.
- .2 Topsoil to be fertile loam material that is free of roots, vegetation, or other debris of a size and quantity that prevents proper placement of the topsoil. The topsoil shall not contain material greater than 25 mm in size, such as stones and clods.
- .3 Topsoil to meet the following physical property requirements:
 - .1 Have an organic content between 7 and 11 % by weight, according to ASTM D2974; and
 - .2 Have a pH from 6.0 to 9.0 according to ASTM D4972.
- .4 Topsoil to meet the mechanical analysis as set out in Table 5-2, Chapter 5 Landscape Guidelines: Landscape Ontario Horticultural Trades Association 2004 (LOHTA 2004).

2.2 FERTILIZER

- .1 Fertilizer to be in accordance with the Canada Fertilizers Act.
- .2 Fertilizer to be in granular form, dry, free flowing without lumps, with a minimum analysis of 16% nitrogen, 3% phosphorus, and 15% potash. The guaranteed analysis ratio shall be 3-1-2.

Part 3 EXECUTION

3.1 GENERAL

- .1 Where required, raise subgrade to rough grade levels with landscape fill, deposit in layers not exceeding 200 mm. Consolidate each layer to minimum 95% Standard Proctor Density.

3.2 PREPARATION OF EXISTING GRADE FOR SODDING

- .1 Verify subgrade elevations are correct.
- .2 Grade soil. Eliminate uneven areas and low spots to ensure positive drainage.
- .3 Cultivate entire area which is to receive topsoil to a depth of 150 mm where practical. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted the soil.
- .4 Remove surface debris, roots, vegetation, branches, and stones in excess of 25 mm in diameter.

3.3 PLACING TOPSOIL

- .1 Do not spread approved topsoil until subgrade has been approved by the DCC Representative.
- .2 Spread topsoil/planting soil mix with adequate moisture in uniform layers over approved, unfrozen subgrade where planting is indicated.
- .3 Topsoil is to be lightly compacted. Keep topsoil 15 mm below finished grade for sodded areas.

3.4 SOIL AMENDMENTS

- .1 Apply lime or other soil amendments at specified rate as determined by soil sample test.
- .2 Mix soil amendment well into full depth of topsoil prior to fertilizer application.

3.5 FERTILIZER

- .1 Fertilizer type and rate of application to be determined from soil test and approved by the DCC Representative.
- .2 Spread fertilizer uniformly over entire area of topsoil.

3.6 FINISH GRADING

- .1 Fine grade entire topsoil area to contours and elevations as indicated or directed. Eliminate rough spots and low areas to ensure positive drainage.
- .2 Prepare loose friable bed by means of raking prior to sodding.
- .3 Leave surface smooth, uniform, and firm against deep foot printing, with a fine loose texture using approved equipment.

3.7 ACCEPTANCE

- .1 DCC Representative will inspect and test topsoil in place and determine acceptance of material, depth, and finish grading.

3.8 CLEANING

- .1 Remove surplus material offsite.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 32 91 19.13: Topsoil Placement and Seeding.

1.2 REFERENCE STANDARDS

- .1 OPSS.MUNI 804 – Construction Specification for Seed and Cover.
- .2 Canada Seeds Act and Regulations.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Division 01.
 - .1 Provide hydraulic seeding schedule for DCC Representative review.
 - .2 Provide fertilizing schedule for DCC Representative review.
- .2 Scheduling:
 - .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
 - .2 Schedule hydraulic seeding during local growing season when moisture level ensures and supports germination and growth.
 - .1 Should sod be required due to hydraulic seeding outside of local growing season, there shall not be an increased cost to the contract.
 - .2 Winter Dormant Period:

SOUTHWESTERN ONTARIO	SOUTHERN ONTARIO	NORTHERN ONTARIO
That area of Ontario south of a line joining Grand Bend and Clarkson.	That area of Ontario between the northern and southern boundaries of Southwestern Ontario and Northern Ontario respectively.	That area of Ontario north of a line joining Waubauskene, Severn Bridge, Bancroft, and Ottawa.
November 15 to April 15 inclusive	November 1 to April 30 inclusive	October 15 to May 15 inclusive

1.4 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 seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.

- .2 Submit two (2) copies of Safety Data Sheets (SDS) in accordance with Section 01 70 12 – Safety Requirements and 01 35 43 – Environmental Procedures.
- .3 Submit in writing 7 days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in liters.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.
- .4 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Work shall be carried out by a member in good standing with the Canadian Nursery Landscaping Association (CNLA), unless otherwise approved by the DCC Representative.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
 - .2 Inoculant containers to be tagged with expiry date.
- .3 Storage and Handling Requirements:
 - .1 Store fertilizer and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged material with new.
- .4 Develop construction Waste Management Plan in accordance with Division 01.
- .5 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Section 01 74 19 – Waste Management and Disposal.

1.7 WARRANTY

- .1 Contractor hereby warrants that seeding will remain free of defects for 1 full growing season.

- .2 End-of warranty inspection will be conducted by DCC Representative.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Seed:

- .1 Permanent Seed Mix and Seed Certificates Analysis Values:

Permanent Seed Mix	Grade Name	Minimum Seed Germination %	Minimum Seed Purity %	Maximum Weed Seed %	Seed Mix %	Seed Species Compositions %
Standard Roadside Mix	Canada #1 Lawn Grass Seed Mixture	70	85	0.5		
Creeping Red Fescue: Festuca rubra					50	50 to 60
Kentucky Bluegrass: Poa pratensis					10	25 to 35
Perennial Ryegrass: Lolium perenne					35	12 to 18
White Clover: Trifolium repens					5	2 to 4

- .2 Application Rates for Seed and Fertilizer:

Permanent Seed Mix	Permanent Seed Mix Rate Kg/10,000 m2	Fertilizer Rate minimum 200 kg/ha			Nurse Crop Rate Kg/10,000 m2
		8-32-16	0-46-0	0-0-60	
Standard Roadside Mix	130	350	-	-	60

- .2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:

- .1 Type I Mulch:

- .1 Made from wood cellulose fibre.
.2 Organic matter content: 95% plus or minus 0.5%.
.3 Value of pH: 6.0.
.4 Potential water absorption: 900%.

- .2 Type II Mulch:

- .1 Made from newsprint, raw cotton fibre and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.
- .3 Tackifier: water dilutable, liquid dispersion.
 - .1 Asphalt based tackifiers are not acceptable.
- .4 Water: free of impurities that would inhibit germination and growth of vegetation.
- .5 Fertilizer:
 - .1 To Canada "Fertilizers Act" and Regulations.
 - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
- .6 Inoculants: inoculant containers to be tagged with expiry date.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for hydraulic seeding in accordance with manufacturer's written instruction.
 - .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 DCC Representative.

3.2 PROTECTION OF EXISTING CONDITIONS

- .1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.
- .2 Immediately remove any material sprayed where not intended as directed by DCC Representative.

3.3 PREPARATION OF SURFACES

- .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .2 Fine grade areas to be seeded free of humps and hollows.
 - .1 Ensure areas are free of deleterious and refuse materials.
- .3 Cultivated areas identified as requiring cultivation to depth of 25 mm.
- .4 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

- .5 Obtain DCC Representative's approval of grade and topsoil depth before starting to seed.

3.4 FERTILIZING PROGRAM

- .1 Fertilize during establishment period based on test results and recommendations. Fertilize minimum three (3) times, in accordance with fertilizing schedule and soils test recommendations.

3.5 PREPARATION OF SLURRY

- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to DCC Representative. Supply equipment required for this work.
- .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
- .3 After materials are in seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

3.6 SLURRY APPLICATION

- .1 Hydraulic seeding equipment:
 - .1 Slurry tank.
 - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.
 - .3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
 - .4 Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".
- .2 Slurry mixture applied per hectare.
 - .1 Seed: grass mixture(s) as indicated.
 - .2 Mulch: Type I and II kg as recommended by supplier.
 - .3 Tackifier: as recommended by supplier.
 - .4 Water: minimum 30,000 L.
 - .5 Fertilizer: as recommended by supplier.
- .3 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
 - .1 Using correct nozzle for application.
 - .2 Using hoses for surfaces difficult to reach and to control application.
- .4 Blend application 300 mm into adjacent grass areas or sodded areas to form uniform surfaces.

- .5 Re-apply where application is not uniform.
- .6 Remove slurry from items and areas not designated to be sprayed.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 19 – Waste Management and Disposal.
 - .1 Leave work area clean at end of each day.
 - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
 - .1 When seed and cover materials are applied to the foliage of trees, shrubs, other susceptible plant material, or waterbodies, the contractor shall immediately remove the seed and cover materials from the areas and wash the areas with clean water.
 - .2 When seed and cover materials are applied to areas or objects other than those designated, the contractor shall remove the seed and cover materials.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 19 – Waste Management and Disposal.
- .3 Waste Management: separate waste material for reuse, recycling in accordance with Division 01.
 - .1 Remove recycling container and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by DCC Representative.

3.8 PROTECTION

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by DCC Representative.

3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.
- .2 Perform following operations from time of seed application until acceptance by DCC Representative.
- .3 Grass Mixture(s):
 - .1 Repair and reseed dead or bare spots to allow establishment of seed before acceptance.

- .2 Mow grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass as directed DCC Representative.
- .3 Fertilize seeded areas after mowing in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles; water it well.
- .4 Control weeds by mechanical means utilizing acceptable integrated pest management practices.
- .5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.10

ACCEPTANCE

- .1 Seeded areas will be accepted by DCC Representative provided that:
 - .1 Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.
 - .2 Areas have been mown at least three (3) times.
 - .3 Areas have been fertilized.
- .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 This section specifies requirements for sodding. Work includes supply and placement of sods complete with all related components and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 32 91 19.13: Topsoil Placement and Grading

1.3 REFERENCE STANDARDS

- .1 OPSS.MUNI 803 Apr 2018 – Construction Specification for Sodding.
- .2 Nursery Sod Growers Association of Ontario.
- .3 Fertilizer Act (R.S., 1985, c. F-10).

1.4 SOURCE QUALITY CONTROL

- .1 Obtain approval of sod source from the DCC Representative.

1.5 DELIVERY, STORAGE AND PROTECTION

- .1 Schedule deliveries to minimize storage at job site without causing delays.
- .2 Schedule sodding to coincide with preparation of soil surface.

1.6 SCHEDULING

- .1 Schedule sodding operations to coincide with preparation of topsoil operations.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Provide product data for mulch, tackifier, and fertilizer.

Part 2 PRODUCTS

2.1 SOD

- .1 Sod to be in accordance with the OPSS.MUNI 803.
- .2 Sod to be a commercial Grade Turfgrass Nursery Sod, either Kentucky Bluegrass or Kentucky Bluegrass/Fine Fescue in accordance with the Specifications and Classifications and Use of Turfgrass Sod for Ontario.

- .1 There shall be no more than 5 broadleaf weeds per 40 m² of sod and up to 20% non-specified grass seed.
- .3 Sod to be of sufficient density that no surface soil is visible.
- .4 The grass height to be 30 mm minimum and 70 mm maximum.
- .5 The soil portion of the sod to be good mineral type soil with a thickness of 10 mm minimum and 15 mm maximum.

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 WOODEN PEGS

- .1 17 x 17 x 150 mm or approved 150 mm long steel staples.

2.4 HERBICIDE

- .1 Type, rate, and method of application subject to approval by the DCC Representative and applicable government agencies.

Part 3 EXECUTION

3.1 PREPARATION OF SURFACES

- .1 To section 32 91 19.13 Topsoil Placement and Grading.

3.2 SODDING

- .1 Topsoiling and finished grade to Section 32 91 19.13 Topsoil Placement and Grading.
- .2 Apply fertilizer at rate recommended by soil sample test.
- .3 Lay sod as soon as possible after lifting to ensure proper establishment.
- .4 Where new sodding abuts existing lawn, cut edge of existing sod with sharp tool in straight line. Lay new sod flush with level of existing lawn.
- .5 Lay sod in rows, parallel with contours, smooth and flush with adjoining areas, and with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. butt sections against curb flush with top of curb, ensure topsoil is well compacted behind curbing. Cut out irregular or thin sections with a sharp knife, edger or equivalent. Where sod abuts curb, compact soil behind curb and lay top of sod flush with top of curb.
- .6 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

- .7 Water sod immediately after laying as dictated by weather conditions to obtain moisture penetration through sod into 150 mm of topsoil.
- .8 Roll sod with a roller having a mass of 50 kg/m of width. Repeated rolling to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 For slopes steeper than (1) horizontal or (2) vertical, install and secure with mesh, in area indicated, in accordance with the manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Ped sod slopes steeper than (3) horizontal to (1) vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to the following pattern:
 - .1 100 mm below top edge at 200 mm on center for first sod sections along contours of slopes.
 - .2 Not less than 3-6 pegs per square meter.
 - .3 Not less than 6-9 pegs per square meter in drainage structures.
 - .4 Adjust pattern as directed by the DCC Representative.
 - .5 Drive pegs to 20 mm above soil surface of sod section.

3.4 MAINTENANCE DURING ESTABLISHMENT

- .1 Perform the following maintenance operations from time of sodding to acceptance:
 - .1 Repair dead or bare spots to allow establishment of sod prior to acceptance.
 - .2 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing shrinkage or erosion.
 - .3 Cut grass to 50 mm, a minimum of twice, when it reaches a height of 70 mm. Remove clippings.
 - .4 Fertilize sodded areas one month after sodding. Spread evenly at manufacturer's suggested rate. Postpone fertilizing until next spring if application falls within four-week prior to expected end of growth season.
 - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
 - .6 Where continued maintenance is required after final acceptance, commence maintenance immediately following installation of work. continue it for one year following final acceptance at Project completion.
 - .7 Notify DCC Representative upon completion of maintenance period to arrange inspection and transfer maintenance responsibility to Owner.
 - .8 Where Municipal (By-Laws) Regulations prohibit the use of Federally or Provincially approved pesticides, and the available (alternative) non-pesticide controls are no acceptable to the Contractor, the application of

pesticides to control weeds, insects, fungus and disease shall be deemed to be removed from Maintenance during Establishment Period.

3.5 ACCEPTANCE

- .1 Grassed areas will be accepted upon completion of the second mowing provided that:
 - .1 Growth is properly established.
 - .2 Area is free of bare and dead spots and 98% weed free.
 - .3 Minimal surface soil is visible when grass has been cut to a height of 50 mm.
- .2 Areas sodded in the fall will be accepted the following spring, one (1) month after the start of growing season provided that acceptance conditions have been met.
- .3 Continue maintenance and mowing until acceptance.

3.6 CLEANING

- .1 Remove surplus material offsite.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 The work to be done under this Section consists of furnishing all materials labours, tools and equipment and performing all operations necessary for the complete reinstatement of surfaces and structures disturbed by the work of this Contract.
- .2 Repair damage or disturbance to surfaces, properties and structures, within limits of the Site or elsewhere on other properties occupied, traversed or otherwise used by the Contractor during the Contract period to a condition equal to or better than that before work began, at no additional cost to the Contract.

1.2 RELATED REQUIREMENTS

- .1 Section 31 23 33.01: Excavating, Trenching and Backfilling.

1.3 MAINTENANCE

- .1 Take care and maintain all reinstated areas until final acceptance of the work.
- .2 Repair damaged areas to the approval of DCC Representative.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Excavating, trenching and backfilling as specified in Section 31 23 33.01.
- .2 Topsoil in accordance with OPSS.MUNI 802 Nov 2019.
- .3 Sodding in accordance with OPSS.MUNI 803 Apr 2018.

Part 3 EXECUTION

3.1 GENERAL

- .1 Maintain surfaces to be reinstated level with adjoining existing surfaces until final reinstatement.

3.2 GRAVEL SURFACES

- .1 Reinstatement granular surfaces with thickness to match existing. Granular surfaces to be smooth and even with adjacent surfaces.

- .2 Place and compact granular for surfaces in accordance with Section 32 11 23 – Aggregate Materials

3.3 ASPHALT SURFACES

- .1 Reinstall asphalt surfaces with thicknesses as indicated.
- .2 Complete work in accordance with OPSS.PROV 313 Apr 2021.

3.4 LANDSCAPED AREAS

- .1 Complete work in accordance with OPSS 802 and OPSS 803.
- .2 Fine grade to smooth surface, all areas to be reinstated.
- .3 Reinstall landscaped surfaces.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 Work covered by this specification consists of furnishing all materials, labour, supervision, equipment, plant and to perform all necessary work to replace maintenance holes and catch basins as noted on the Contract Drawings. This Section also specifies requirements for the repair and adjustment to grade of existing precast concrete manholes, catch basins, and structures.

1.2 RELATED REQUIREMENTS

- .1 Section 31 23 33.01: Excavating, Trenching and Backfilling.
- .2 Section 33 31 11: Sanitary Sewage Gravity Piping.
- .3 Section 33 41 00: Storm Utility Drainage Piping.

1.3 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS.MUNI 407 Nov 2021 – Construction Specification for New Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation.
 - .2 OPSS.MUNI 408 Nov 2021 – Adjusting or Rebuilding Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers.
 - .3 OPSS.MUNI 1004 Nov 2021 – Material Specification for Aggregates –
 - .4 OPSS.MUNI 1301 Nov 2018 – Material Specification for Cementing Materials.
 - .5 OPSS.MUNI 1302 Nov. 2019 – Material Specification for Water.
 - .6 OPSS.MUNI 1350 Nov 2019 – Material Specification for Concrete – Materials and Production.
 - .7 OPSS.MUNI 1351 Nov 2019 – Material Specification for Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers.
 - .8 OPSS.MUNI 1853 Nov 2018 – Material Specification for Rubber Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
 - .9 OPSS.MUNI 1854 Nov 2019 – Material Specification for High Density Polyethylene (HDPE) and Expanded Polystyrene (EPS) Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
 - .10 OPSS.MUNI 1850 Nov 2020 – Material Specification for Frames, Grates, Covers, and Gratings.
- .2 Ontario Provincial Standard Drawings (OPSD)

- .1 OPSD 401.010 Nov 2018 – Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes
- .2 OPSD 400.070 Nov 2018 – Cast Iron, Raised Square Frame with Circular Flat Grate for Catch Basin, Herring Bone Openings.
- .3 OPSD 401.030 – Nov 2018 – Cast Iron, Square Frame with Circular Watertight Cover for Maintenance Holes
- .4 OPSD 405.010 Nov 2018 – Maintenance Hole Steps, Hollow.
- .5 OPSD 701.010 Nov 2014 – Precast Concrete Maintenance Hole, 1200 mm.
- .6 OPSD 701.011 Nov 2014 – Precast Concrete Maintenance Hole, 1500 mm.
- .7 OPSD 705.010 Nov 2019 – Precast Concrete Catch basin, 600 mm x 600 mm.
- .3 CSA Group (CSA)
 - .1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
- .4 ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV).

1.4 SOURCE QUALITY CONTROL

- .1 DCC Representative will inspect material at construction site.
- .2 Provide verification to DCC Representative that Stormwater Quality Treatment Unit is verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV).

1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 for:
 - .1 Manhole Sections.
 - .2 Metal Casting.
 - .3 Gaskets.
 - .4 Frame and grate.

1.6 HANDLING AND STORAGE

- .1 Prevent damage to materials during storage and handling in accordance with the manufacturer's written instructions.
- .2 Store gaskets in cool location out of direct sunlight, and away from petroleum products.
- .3 Replace defective or damaged materials with new at no additional cost to Contract.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Diameter and type: as shown on the project drawings.
- .2 Concrete: to OPSS.MUNI 1350 Nov 2019.
- .3 Frames, gratings, covers: in accordance with OPSS.MUNI 1850 Nov 2020.
 - .1 Maintenance hole frames and covers: to OPSD 401.010:
 - .1 Type A Closed for Sanitary Manhole and labeled "Danger Sanitary Sewer".
 - .2 Type B Open for Storm Manhole and labeled "Danger Storm Sewer".
 - .2 Watertight cover for maintenance hole: to OPSD 401.030
 - .1 As indicated.
 - .3 Catch basin frames and covers: to OPSD 400.070.
- .4 Precast maintenance holes: to OPSD 701.010 and OPSD 701.011.
- .5 Precast catch basin sections: to OPSD 705.010.
- .6 Ladder rungs: to OPSD 405.010.
- .7 Mortar to consists of one part Portland cement and three parts mortar sand and mixed with minimum amount of water to obtain optimum consistency for use intended. Do no use additives.
 - .1 Portland Cement: OPSS.MUNI 1301 Nov 2018.
 - .2 Mortar Sand: OPSS.MUNI 1004 Nov 2013.
 - .3 Water: OPSS 1302 Nov. 2019.
- .8 Adjustment rings:
 - .1 Concrete: OPSS 1351 Nov 2019.
 - .1 OPSD 704.010 Nov 2014 – Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
 - .2 Rubber: OPSS.MUNI 1853 Nov 2018.
 - .1 OPSD 704.013 Nov 2018 – Rubber Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
 - .3 HDPE and EPS: OPSS.MUNI 1854 Nov 2019.
 - .1 OPSD 704.011 Nov 2018 – High Density Polyethylene (HDPE) Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
 - .2 OPSD 704.012 Nov 2018 – Expanded Polystyrene (EPS) Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.

.9 Stormwater Quality Treatment Unit

- .1 The stormwater quality treatment unit shall be sized for a drainage area of 0.364 ha with runoff coefficient of 0.75 for the rainfall gauge located at Kingston Pumping Station.

.1 Rainfall Gauge ID – 4175.

- .2 The stormwater quality treatment unit shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.

.1 Particle Size Distribution Table

PARTICLE DIAMETER (MICRONS)	PERCENTAGE (%)	SPECIFIC GRAVITY
2	5	2.65
5	5	2.65
8	10	2.65
20	15	2.65
50	10	2.65
75	5	2.65
100	10	2.65
150	15	2.65
250	15	2.65
500	5	2.65
1000	5	2.65

- .3 The stormwater quality treatment unit shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

.1 Minimum flow loading of 6.7 L/s, which corresponds to 90% of the Average Annual Runoff based on 44 years of Kingston Pumping Station rainfall data.

.2 Minimum sediment loading of 73 kg, which corresponds to treating 90% of the average annual runoff volume, 1214 m³, with a suspended sediment concentration of 60 mg/L.

- .4 The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the internal components.

- .5 Access shall have a minimum of 1.524 m clear vertical clear space over all of the filter cartridges.

- .6 Filter cartridges shall be able to be lifted straight vertically out of their installed placement for the entire length of the cartridge.

- .7 The Filter device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants.
- .10 Orifice
 - .1 The orifice shall be capable of regulating flow to 11.9 L/s at a head value of 2.95m.
 - .2 System should be capable of operating for extended periods without requiring servicing.
 - .3 The orifice shall utilize a vertical vortex flow regulation mechanism.

Part 3 EXECUTION

3.1 PREPARATION

- .1 Inspect product for defects and remove defective products from site.

3.2 EXCAVATION AND BACKFILL

- .1 Excavation and backfill to Section 31 23 33.01.
- .2 Obtain approval of DCC Representative before installing maintenance holes or catch basins.

3.3 CONCRETE WORK

- .1 Do concrete work to CSA A23.1/A23.2.
- .2 Position metal inserts to dimensions and details shown or required.

3.4 INSTALLATION

- .1 Construct units to details indicated, plumb and true to alignment and grade.
- .2 Complete maintenance holes as pipe laying progresses.
- .3 Dewater excavation dry and remove soft and foreign material before placing concrete base.
- .4 Set precast concrete slab on 300 mm minimum of well compacted Granular 'A' material.
- .5 Set bottom section of precast unit in place. Make each successive joint watertight with approved rubber ring gaskets, mastic joint filler, cement mortar, or combination thereof.
- .6 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

- .7 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
- .8 For sanitary sewers:
 - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
 - .2 Bench to provide a smooth U-shaped channel. Side height of channel to be as per OPSD 701.021.
- .9 For storm sewers:
 - .1 Maintenance Holes: provide 300 mm sump.
 - .2 Catch Basins: provide 600 mm sump.
 - .3 Catch Basin Manholes: provide 300 mm sump.
- .10 Installing Stormwater Quality Treatment Unit
 - .1 Install per manufacturer's recommendations.
- .11 Installing Orifice
 - .1 Install per manufacturer's recommendations.
- .12 Installing units in existing systems:
 - .1 Where new unit is within existing run of pipe, carefully remove existing pipe to dimensions required and install new unit as specified.
 - .2 Make joints watertight between new unit and existing pipe.
 - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready to be put into operation, complete the installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or any other necessary work.
- .13 Set frame and cover in accordance with OPSS 407.
- .14 Place frame and cover on top section to elevation matching as indicated. If adjustment required use concrete ring.
- .15 Clean units of debris and foreign materials; remove fins or sharp protuberances. Prevent debris from entering system.

3.5 ADJUSTING TOPS EXISTING UNITS

- .1 Remove existing gratings, and frames, and of store for re-use at locations designated by DCC Representative.
- .2 Sectional units:
 - .1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
 - .2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then

replace cone section. When amount of raise is less than 600 mm use standard maintenance hole brick, moduloc or grade rings.

.3 Monolithic units:

- .1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with:
 - .1 Mortared brick course for 150 mm or less alteration.
 - .2 Cast-in-place concrete.
- .2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
- .3 When monolithic units with tapered upper section are to be lowered more than 150 mm remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
- .4 Install additional maintenance hole ladder rungs in adjusted portion of units as required.
- .5 Re-use existing gratings, frames.
- .6 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

3.6 SITE QUALITY CONTROL

.1 Test maintenance holes and structures:

- .1 Leakage test method in accordance with OPSS 407.
- .2 Leakage not to exceed a rate of three liters per hour per meter of head above the lowest pipe invert in the maintenance hole.

.2 Stormwater Quality Treatment Unit field test performance

- .1 Field tests shall have monitored a minimum of twenty qualifying storm events, and report at minimum the following results:
 - .1 A qualifying storm event is considered as having:
 - .1 A minimum rainfall event depth of 0.1 inch.
 - .2 A minimum inter-event duration of 6 hours.
 - .2 Suspended Solids Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.
 - .3 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

.3 Provide labour, equipment and materials required to perform testing.

.4 Backfill prior to testing.

- .5 Notify DCC Representative 24 hours in advance of proposed test. Do test in presence of DCC Representative.

3.7 CLEANING

- .1 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 Work covered by this specification consist of furnishing all materials, labour, supervision, equipment, plant and to perform all necessary work for construction of watermain.

1.2 REFERENCES

- .1 Ontario Provincial Standard Specifications
 - .1 OPSS.MUNI 441 Nov 2021 – Watermain Installation in Open Cut.
 - .2 OPSS.MUNI 442 Nov 2020 – Corrosion Protection of Watermain.
 - .3 OPSS.MUNI 510 Nov 2018 – Construction Specification for Removal.
 - .4 Ontario Provincial Standard Drawings
 - .1 OPSD 1109.030 – Insulation for Sewers and Watermains in Shallow Trenches.
 - .2 OPSD 802.010 – Flexible Pipe Embedment and Backfill, Earth Excavation.
 - .3 OPSD 1103.010 – Concrete Thrust Blocks for Tees, Plugs, and Horizontal Bends.
 - .4 OPSD 1103.020 – Concrete Thrust Blocks for Vertical Bends.
 - .5 OPSD 1103.021 – Dimension Tables for Concrete Thrust Blocks for Vertical Bends.
 - .6 OPSD 1105.010 – Hydrant, Installation.
 - .7 OPSD 1109.010 – Cathodic Protection for Metallic Watermain Systems.
 - .8 OPSD 1109.011 – Cathodic Protection for PVC Watermain System.
 - .5 MECP Water Disinfection Procedure (latest edition).
 - .6 American Water Works Association ANSI/AWWA C651 – Disinfecting Watermains.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Schedule work to minimize interruptions to existing services.
- .2 If required submit schedule of expected interruptions to DCC Representative for approval and adhere to interruption schedule as approved by DCC Representative.
- .3 Notify DCC Representative minimum 48 hours in advance of interruption in service.

- .4 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
- .5 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .6 Provide and post "Out of Service" sign on hydrant not in use.
- .7 Advise DCC Representative of anticipated interference with movement of traffic.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this section in accordance with Section 01 33 00.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, maintenance and operating instructions.
- .2 Include top of pipe, horizontal location of fittings and type and valves.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Dispose of unused disinfection material at official hazardous material collections site approved by DCC Representative.
- .3 Do not dispose of unused disinfection material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 PIPE, JOINTS, AND FITTINGS

- .1 Polyvinyl Chloride Pipe (PVC): to AWWA C900 and CSA B137.3, Color blue, pressure class 235 DR 18, size as indicated.
- .2 Joints and Fittings for PVC Pipe
 - .1 Joints:
 - .1 Bell and spigot with rubber gaskets.
 - .2 Fittings:

- .1 Mechanical joint cast iron and ductile iron fittings NPS 3 inches and larger in accordance with ANSI/AWWA C110/A21.10.
 - .2 Fittings to be mechanically restrained.
- .3 Valves
 - .1 Valves to open counterclockwise.
 - .2 Gate valve: to AWWA C509, standard iron body, mounted valves with non-rising stems, suitable for 1 MPa with mechanical joints.
 - .3 Size: as indicated.
 - .4 Valve operator: to OPSP 1101.020
- .4 Valve Boxes
 - .1 Cast iron valve box: three piece sliding type adjustable complete with valve operating extension rod, 37.5 mm diameter, of such length that when set on valve operating nut top of rod will not be more than 150 mm below cover.
 - .2 Top of cast iron box marked "WATER" / "EAU".
- .5 Cathodic Protection
 - .1 Cathodic protection: to OPSP 442, OPSP 1109.010 and OPSP 1109.011.
- .6 Tracer Wire
 - .1 12-gauge TWU stranded copper, light-colored plastic-coated tracer wire.

2.2 HYDRANTS

- .1 Hydrant: to match Utility Kingston hydrants, with two 65 mm threaded nozzles, one 100 mm Storz connector, for Kingston Fire Department use. 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main.
 - .1 Hydrants to open counterclockwise, threads to local standards. Provide metal caps and chains.
- .2 Hydrant paint: Rapid Dry Gloss Alkyd Enamel in accordance with NFPA 291 – Recommended Practice for Water Flow Testing and Marking of Hydrants (Latest Edition).

2.3 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material in accordance with Section 32 11 23 – Aggregate Materials:
 - .1 Bedding: Granular 'A'.

2.4 PIPE ABANDONMENT MATERIALS

- .1 Unshrinkable fill for abandoned pipes shall be according to OPSP PROV 578 and Section 31 23 33.01.

2.5 PIPE INSULATION

- .1 Pipe insulation shall be extruded polystyrene in accordance with OPSD 1109.030.

2.6 BACKFILL MATERIAL

- .1 In accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

2.7 PIPE FLUSHING, DISINFECTION AND TESTING

- .1 Complete hydrostatic pressure test in accordance with OPSS 441.
- .2 Flush and disinfect water mains in accordance with MECP Watermain Disinfection Procedure (latest edition).
- .3 Refer to Section 01 35 43 – Environmental Procedures for additional disinfection requirements and environmental consideration.

Part 3 EXECUTION

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
 - .1 Inspect material for defects to approval of DCC Representative.
 - .2 Remove defective materials from site as directed by DCC Representative.

3.2 TRENCHING

- .1 Trenching work to be in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .2 Trench depth to provide pipe cover of not less than 2.4 m from finished grade or insulate pipe as specified herein.
- .3 Trench alignment and depth require DCC Representative's approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Perform bedding in accordance with Section 31 23 33.01.
- .2 Place bedding in unfrozen condition.
- .3 Place granular bedding materials to details indicated or directed.
- .4 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.

- .5 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
- .6 Compact full width of bed to at least 95% Standard Proctor Density.
- .7 Use bedding stone in lieu of sand bedding material.

3.4 PIPE ABANDONMENT

- .1 Complete work in accordance with OPSS. MUNI 510.
- .2 Pipes shall be filled with unshrinkable fill for abandoned pipes in accordance with OPSS.PROV 578 and Section 31 23 33.01.

3.5 PIPE INSTALLATION

- .1 Complete work in accordance with OPSS 441.
- .2 Terminate building water service 1 m outside building wall.
 - .1 Install coupling necessary for connection to building plumbing.
 - .2 If plumbing is already installed, make connection; otherwise, cap or seal end of pipe and place temporary marker to locate pipe end.
- .3 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .4 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .5 Position and join pipes with equipment and methods approved by DCC Representative.
- .6 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .7 Align pipes before joining.
- .8 Complete each joint before laying next length of pipe.
- .9 Minimize deflection after joint has been made.
- .10 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

- .11 Do not lay pipe on frozen bedding.
- .12 Backfill remainder of trench.
- .13 Do hydrostatic and leakage test as specified herein and have results approved by DCC Representative.

3.6 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes by means of concrete located between valve and solid ground.

3.7 HYDRANT INSTALLATION

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA M17, OPSS.MUNI 441, and OPSD 1105.010.
- .3 Install 150 mm gate valve and cast-iron valve box on hydrant leads as indicated.
- .4 Set hydrants plumb, with house outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 100 mm above final grade.
- .5 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.8 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 Place concrete thrust blocks between valves, tees, pugs, caps, bends, changes in pipe diameter, reducers, hydrants, and fittings and undisturbed ground as directed by DCC Representative.
- .2 Keep joints and coupling free of concrete.
- .3 For restrained joints: only use restrained joints approved by DCC Representative.

3.9 TRACER WIRE

- .1 Install tracer wire on all non-ductile iron watermains, hydrant laterals and water services except where such water service pipe is of copper material.
- .2 Install wire in a manner as to be able to properly trace all watermains, hydrant laterals and water services without loss or deterioration of signals or without the transmitted signal migrating off the tracer wire.

3.10 PIPE INSULATION

- .1 Minimum insulation thickness = 50 mm.
- .2 Minimum insulation compressive strength = 275 kPa.
- .3 Pipes with less than 1.7 m of cover shall be insulated in accordance with OPSD 1109.030.

3.11 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with OPSS.MUNI 441.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify DCC Representative 24 hours in advance of proposed test. Do test in presence of DCC Representative.

3.12 FLUSHING AND DISINFECTING

- .1 Complete work in accordance with MECP Watermain Disinfection Procedure (latest edition) and ANSI/AWWA C651 – Disinfecting Watermains (latest edition).
- .2 Flushing and disinfecting operations witnessed by DCC Representative.
 - .1 Notify DCC Representative at least 2 days in advance of proposed date when disinfecting operations will begin.
- .3 Continuous Feed Method of Chlorination to be used in accordance with ANSI/AWWA C651.
 - .1 Direct-feed chlorination is not permitted.
- .4 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 0.91 m/s, to ensure the removal of all particulates.
 - .1 Where flow rates are not possible, flushing at the maximum expected flow rate for the line for 2-3 volumes or swabbing can be used at the discretion of the DCC Representative.
- .5 Provide connections and pumps for flushing in accordance with ANSI/AWWA C651 for indicated pipe diameters.
- .6 Operate service connection by opening and closing to ensure thorough flushing.
 - .1 Ensure flushing is completed to DCC Representative approval.
- .7 Hydrostatic and leakage testing to be completed prior to chlorination.
 - .1 Obtain DCC Representative approval of the hydrostatic and leakage test prior to commencing disinfecting activities.

- .8 Potable water may be supplied from a temporary backflow-protected connection to the existing distribution system or other supply source approved by the DCC Representative.
 - .1 The flow shall be supplied at a constant rate into the main.
- .9 Introduce a dose of chlorine fed at a constant rate such that the water will have not less than 25mg/L free chlorine at a point not more than 3 meters downstream from the beginning of the water main.
 - .1 The free chlorine rate shall be measured at regular intervals as directed by the DCC Representative.
- .10 Chlorine application shall continue until the main is filled with chlorinated water and it shall be contained in the main for at least 24 hours.
 - .1 Valves and hydrants in the treated section shall be opened to ensure proper disinfection.
- .11 Once the 24-hour period is reached, the treated water in the water main shall have a residual of not less than 10 mg/L of free chlorine.
- .12 Flush the main, fittings, valves and branches of the system until the chlorine measurements are acceptable for domestic use, as directed by the DCC Representative.
 - .1 Discharging chlorinated water to the storm sewer is prohibited.
 - .2 Chlorinated water to be discharged to the sanitary sewer.
 - .1 Shall sanitary sewer not be available, ensure that the disposal of the chlorinated water is discharged to an area where it can not cause environmental damage. This area shall be inspected and if DCC Representative deemed the chlorinated water to cause damage to the area, a neutralizing chemical shall be applied to the discharged water.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out. There are two (2) options available:
 - .1 Option 1: Take an initial set of samples and resample again after 16 hours. Both sets of samples must pass for the main to be approved by DCC Representative for release.
 - .2 Option 2: After 16 hours of without any water use, take 2 sets of samples 15 minutes apart minimum while sampling taps are left running. Both sets of samples must pass for the main to be approved by DCC Representative for release.
- .14 Samples shall be collected every 370 meters of the new water mains, as well as from the end of the line and at least one from each branch greater than one pipe length.
- .15 The water main may be re-flushed if the initial disinfection fails to produce satisfactory bacteriological results.

- .1 The water main shall be re-chlorinated by continuous feed method if check samples fail to provide acceptable results.
- .16 The system shall not be put into operation until approval has been given by DCC Representative.

3.13 PAINTING OF HYDRANTS

- .1 Color: Red.

3.14 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original conditions as directed by DCC Representative.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 Work covered by this specification consists of furnishing all materials, labour, supervision, equipment, plant and to perform all necessary work to replace or repair existing sanitary sewers while maintaining flows, as noted on the Contract Drawings.

1.2 RELATED REQUIREMENTS

- .1 Section 31 23 33.01: Excavating, Trenching and Backfilling.
- .2 Section 33 05 16: Maintenance Holes and Catch Basins Structures.

1.3 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS.MUNI 409 Nov 2017 – Construction Specification for Closed-Circuit Television (CCTV) Inspection of Pipelines.
 - .2 OPSS.MUNI 410 Nov 2018 – Construction Specification for Pipe Sewer Installation in Open Cut.
 - .3 OPSS.MUNI 510 Nov 2018 – Construction Specification for Removal.
 - .4 OPSS.MUNI 1841 Nov 2019 – Material Specification for Non-Pressure Polyvinyl Chloride (PVC) Pipe Products
- .2 Ontario Provincial Standard Drawings (OPSD)
 - .1 OPSD 806.040 Nov 2018 – Height of Fill Table, Polyvinyl chloride Gravity Sewer Pipe, 210, 320, and 6935kPa.
 - .2 OPSD 1109.030 Nov 2020 – Insulation for Sewers and Watermains in Shallow Trenches
- .3 ASTM International
 - .1 ASTM D 3034-21, Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

1.4 MATERIAL CERTIFICATION

- .1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this section in accordance with section 01 33 00.
- .2 The pipe Stiffness of polyvinyl chloride pipe shall be per OPSD 806.040
- .3 The Contractor shall inform the DCC Representative if the Minimum Height of fill over top of the pipe as specified in OPSD 806.021 and OPSD 806.040 is less than recommended.

1.5 SCHEDULING OF WORK

- .1 Schedule work to minimize interruptions to existing services.
- .2 Maintain existing sewage flows during construction.
- .3 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.6 MANUFACTURER'S INSTRUCTIONS

- .1 Make available 1 copy of manufacturer's installation instructions.

1.7 SUBMITTALS

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

1.8 HANDLING AND STORAGE

- .1 Handle and store pipe and fittings in such a manner to avoid shock and damage. Do not use chains or cables passed through pipe bore.
- .2 Store materials in accordance with manufacturer's recommendations.
- .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 PLASTIC PIPE

- .1 Polyvinyl Chloride pipe products shall be in accordance with OPSS.MUNI 1841.
 - .1 Pipe Class:
 - .1 SDR-28 for pipes up to 150 mm diameter.
 - .2 SDR-35 for pipes over 150 mm diameter.

2.2 PIPE BEDDING MATERIALS

- .1 Granular material in accordance with Section 32 11 23 – Aggregate Materials:
 - .1 Bedding: Granular 'A'

2.3 PIPE JOINTS

- .1 Bell and spigot joints with elastomeric gaskets.

2.4 PIPE ABANDONMENT MATERIALS

- .1 Unshrinkable fill for abandoned pipes shall be according to OPSS.PROV 578 and Section 31 23 33.01.

2.5 PIPE INSULATION

- .1 Pipe insulation shall be extruded polystyrene in accordance with OPSD 1109.030.

Part 3 EXECUTION

3.1 TEMPORARY SEWER BYPASS

- .1 The Contractor will be required to maintain the conveyance of all flows by means of pumping or bypassing. Bypass pipes to be sized to, at minimum, equal capacity of sewer being replaced or repaired.
- .2 The work is not to stop or impede the main flows under any circumstances.
- .3 The Contractor shall inspect the Temporary Sewer Bypass three (3) times daily including weekends and holidays. The inspection reports shall be logged and provided to the DCC Representative upon request.
- .4 Removal of the Temporary Sewer Bypass and restoration to existing conditions of any area disturbed by the Temporary Sewer Bypass is to be included with this work.

3.2 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

3.3 TRENCHING AND BACKFILL

- .1 Perform trenching and backfilling in accordance with Section 31 23 33.01.
- .2 Trench alignment and depth to approval of DCC representative prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

- .1 Place bedding in accordance with Section 31 23 33.01.
- .2 Place bedding in unfrozen condition.
- .3 Place granular bedding materials to details indicated or directed.
- .4 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
- .5 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
- .6 Compact full width of bed to at least 95% Standard Proctor Density.

- .7 Use bedding stone in lieu of sand bedding material.
- .8 Fill excavation below bottom of specified bedding adjacent to maintenance holes or catch basins with bedding material or common backfill as directed.

3.5 INSTALLATION

- .1 Complete work in accordance with OPSS 407 and 410.
- .2 Lay and join pipe and fittings as specified herein and in accordance with the manufacturer's recommendations.
- .3 Handle pipe by approved methods. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length with the following tolerances:
 - .1 Horizontal Alignment: 50mm.
 - .2 Vertical Alignment: the lesser of 13mm or one half the rise per pipe length.
- .5 Commence laying at outlet and proceed in upstream direction.
- .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .7 Do not allow water to flow through pipes during construction except as may be permitted by DCC Representative.
- .8 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.
- .9 Joints:
 - .1 Polyvinyl Chloride pipe:
 - .1 Bell and spigot joints with elastomeric gaskets.
- .10 When any stoppage of work occurs, block pipes as directed to prevent "creep" during down time.
- .11 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.
- .12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .13 Make watertight connections to maintenance holes. Use non-shrink grout when suitable gaskets are not available.

- .14 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.
- .15 Plug open upstream ends of pipes with removable watertight concrete, steel or wooden bulkheads.

3.6 PIPE ABANDONMENT

- .1 Complete work in accordance with OPSS. MUNI 510.
- .2 Pipes shall be filled with unshrinkable fill for abandoned pipes in accordance with OPSS.PROV 578 and Section 31 23 33.01.

3.7 PIPE INSULATION

- .1 Minimum insulation thickness = 50 mm.
- .2 Minimum insulation compressive strength = 275 kPa.
- .3 Pipes with less than 1.8 m of cover shall be insulated in accordance with OPSD 1109.030.

3.8 FIELD TESTING

- .1 Complete work in accordance with OPSS. MUNI 410 Nov 2014.
- .2 Brace caps, bends and tees to prevent movement during tests.
- .3 Repair or replace pipe, pipe joint or bedding if found defective.
- .4 Draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
 - .1 Test shall be witnessed by DCC Representative.
- .5 Remove foreign material from sewers and related appurtenances by flushing with water.
- .6 Leakage test shall be applied to sanitary pipe sewers in accordance with OPSS 410.
 - .1 Low pressure air testing in accordance with OPSS 410 is acceptable in lieu of infiltration / exfiltration testing.
- .7 Television and photographic inspections:
 - .1 Carry out inspection of installed sewers (new and replaced) by television camera, photographic camera or by other related means in accordance with OPSS.MUNI 409 Nov 2017.
 - .2 Provide means of access to permit DCC Representative to do inspections.

- .8 Notify DCC Representative 24 hours in advance of proposed test. Do test in presence of DCC Representative.
- .9 Provide labour, equipment and materials required to perform testing.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE OF WORK

- .1 Work covered by this specification consists of furnishing all materials, labour, supervision, equipment, plant and to perform all necessary work for constructing storm sewers.

1.2 RELATED REQUIREMENTS

- .1 Section 31 23 33.01: Excavating, Trenching and Backfilling.
- .2 Section 33 05 16: Maintenance Holes and Catch Basins Structures.

1.3 REFERENCE STANDARDS

- .1 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS.MUNI 409 Nov 2017 – Construction Specification for Closed-Circuit Television (CCTV) Inspection of Pipelines.
 - .2 OPSS.MUNI 410 Nov 2018 – Construction Specification for Pipe Sewer Installation in Open Cut.
 - .3 OPSS.MUNI 510 Nov 2018 – Construction Specification for Removal.
 - .4 OPSS.MUNI 1841 Nov 2019 – Material Specification for Non-Pressure Polyvinyl Chloride (PVC) Pipe Products.
- .2 Ontario Provincial Standard Drawings (OPSD)
 - .1 OPSD 806.040 Nov 2018 – Height of Fill Table, Polyvinyl chloride Gravity Sewer Pipe, 210, 320, and 6935kPa.
 - .2 OPSD 802.010 Nov 2014 – Flexible Pipe Embedment and Backfill, Earth Excavation.
 - .3 OPSD 1109.030 Nov 2020 – Insulation for Sewers and Watermains in Shallow Trenches.

1.4 MATERIAL CERTIFICATION

- .1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this section in accordance of Section 01 33 00.
- .2 The pipe Stiffness of polyvinyl chloride pipe shall be per OPSD 806.040.
- .3 The Contractor shall inform the DCC Representative if the Minimum Height of fill over top of the pipe as specified in 806.021, 806.040, is less than recommended.

1.5 SCHEDULING OF WORK

- .1 Schedule work to minimize interruptions to existing services.

- .2 Maintain existing flow during construction.
- .3 Submit schedule of expected interruptions for review and adhere to approved schedule.

1.6 MANUFACTURER'S INSTRUCTIONS

- .1 Make available 1 copy of manufacturer's installation instructions.

1.7 SUBMITTALS

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

1.8 HANDLING AND STORAGE

- .1 Handle and store pipe and fittings in such a manner to avoid shock and damage. Do not use chains or cables passed through pipe bore.
- .2 Store materials in accordance with manufacturer's recommendations.
- .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 PLASTIC PIPE

- .1 Polyvinyl Chloride pipe products shall be in accordance with OPSS.MUNI 1841.
 - .1 Pipe Class:
 - .1 SDR-28 for pipes up to 150 mm diameter.
 - .2 SDR-35 for pipes over 150 mm diameter.

2.2 PIPE BEDDING MATERIALS

- .1 Granular material in accordance with Section 32 11 23 – Aggregate Materials:
 - .1 Bedding: Granular 'A'

2.3 PIPE JOINTS

- .1 Bell and spigot joints with elastomeric gaskets

2.4 PIPE ABANDONMENT MATERIALS

- .1 Unshrinkable fill for abandoned pipes shall be according to OPSS.PROV 578 and Section 31 23 33.01.

2.5 PIPE INSULATION

- .1 Pipe insulation shall be extruded polystyrene in accordance with OPSD 1109.030.

Part 3 EXECUTION

3.1 TEMPORARY SEWER BYPASS

- .1 The Contractor will be required to maintain the conveyance of all flows by means of pumping or bypassing. Bypass pipes to be sized to, at minimum, equal capacity of sewer being replaced or repaired.
- .2 The work is not to stop or impede the main flows under any circumstances.
- .3 The Contractor shall inspect the Temporary Sewer Bypass three (3) times daily including weekends and holidays. The inspection reports shall be logged and provided to the DCC Representative upon request.
- .4 Removal of the Temporary Sewer Bypass and restoration to existing conditions of any area disturbed by the Temporary Sewer Bypass is to be included with this work.

3.2 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.3 TRENCHING AND BACKFILLING

- .1 Perform trenching and backfilling in accordance with Section 31 23 33.01.
- .2 Trench alignment and depth to approval of DCC representative prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

- .1 Place bedding in accordance with Section 31 23 33.01.
- .2 Place bedding in unfrozen condition.
- .3 Place granular bedding materials to details indicated or directed.
- .4 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
- .5 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
- .6 Compact full width of bed to at least 95% Standard Proctor Density.
- .7 Use bedding stone in lieu of sand bedding material.
- .8 Fill excavation below bottom of specified bedding adjacent to maintenance holes or catch basins with bedding material or common backfill as directed.

3.5 INSTALLATION

- .1 Complete work in accordance with OPSS 410.
- .2 Lay and join pipe and fittings as specified herein and in accordance with manufacturer's recommendations.
- .3 Handle pipe by approved methods. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length with the following tolerances:
 - .1 Horizontal Alignment: 50mm.
 - .2 Vertical Alignment: the lesser of 13mm or one half the rise per pipe length.
- .5 Commence laying at outlet and proceed in upstream direction.
- .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .7 Do not allow water to flow through pipes during construction except as may be permitted by DCC Representative.
- .8 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.
- .9 Joints:
 - .1 Polyvinyl Chloride pipe:
 - .1 Bell and spigot joints with elastomeric gaskets.
- .10 When any stoppage of work occurs, block pipes as directed to prevent "creep" during down time.
- .11 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.
- .12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .13 Make watertight connections to maintenance holes and catch basins. Use non-shrink grout when suitable gaskets are not available.
- .14 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.
- .15 Plug open upstream ends of pipes with removable watertight concrete, steel or wooden bulkheads.

3.6 PIPE ABANDONMENT

- .1 Complete work in accordance with OPSS.MUNI 510.
- .2 Pipes shall be filled with unshrinkable fill for abandoned pipes shall be according to OPSS.PROV 578 and Section 31 23 33.01.

3.7 PIPE INSULATION

- .1 Minimum insulation thickness = 50 mm.
- .2 Minimum insulation compressive strength = 275 kPa.
- .3 Pipe with less than 1.0 m of cover shall be insulated in accordance with OPSS 1109.030.

3.8 FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding if found defective.
- .2 Brace caps, bends and tees to prevent movement during tests.
- .3 Repair or replace pipe, pipe joint or bedding if found defective.
- .4 Draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
 - .1 Test shall be witnessed by DCC Representative.
- .5 Remove foreign material from sewers and related appurtenances by flushing with water.
- .6 Leakage test shall be applied to storm pipe sewers in accordance with OPSS 410.
 - .1 Low pressure air testing in accordance with OPSS 410 is acceptable in lieu of infiltration / exfiltration testing.
- .7 Television and photographic inspections:
 - .1 Carry out inspection of installed sewers (new and replaced) by television camera, photographic camera or by other related means in accordance with OPSS.MUNI 409 Nov 2017.
 - .2 Provide means of access to permit DCC Representative to do inspections.
- .8 Notify DCC Representative 24 hours in advance of proposed test. Do test in presence of DCC Representative.
- .9 Provide labour, equipment and materials required to perform testing.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 - .2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- .2 CSA Group (CSA)
 - .1 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
 - .2 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .3 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings for precast manholes.
- .4 Quality Assurance Submittals: Submit in accordance with Section 26 05 00 Common Work Results for Electrical.
 - .1 Test Reports: Submit certified test reports for specified materials from approved independent testing laboratories, indicating compliance 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.
- .5 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Preinstallation Meetings: convene preinstallation meeting one week before beginning work of this Section and on-site installation, with DCC Representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical.

Part 2 Products

2.1 PVC DUCTS

- .1 PVC ducts, type EB1, encased in reinforced concrete.

2.2 PVC DUCT FITTINGS

- .1 Rigid PVC opaque solvent welded translucent pushfit type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.
- .2 Expansion joints.
- .3 Rigid PVC 5-degree angle couplings.

2.3 CABLE PULLING EQUIPMENT

- .1 Pulling iron: galvanized steel rods, size and shape as indicated.
- .2 Pull rope: 6 mm stranded nylon, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.4 MARKERS

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

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install underground duct banks including formwork.
- .2 Build duct bank on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density.
- .3 Open trench completely between manholes before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.
- .4 Before laying ducts, construct "mud slab" not less than 75 mm thick.
- .5 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.
- .6 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.
- .7 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 75 mm horizontally and vertically.
 - .1 Stagger joints in adjacent layers at least 150 mm and make joints watertight.
 - .2 Encase duct bank with 75 mm thick concrete cover.
 - .3 Use galvanized steel conduit for sections extending above finished grade level.
- .8 Make transpositions, offsets and changes in direction using 5-degree bend sections, do not exceed a total of 20 degree with duct offset.
- .9 Use bell ends at duct terminations in manholes or buildings.
- .10 Use conduit to duct adapters when connecting to conduits.
- .11 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.
- .12 Cut, ream and taper end of ducts on site in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .13 Allow concrete to attain 50% of its specified strength before backfilling.
- .14 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete.
 - .1 Tie ducts to spacers with twine or other non-metallic material.
 - .2 Remove weights or wood braces before concrete has set and fill voids.
- .15 Clean ducts before laying:
 - .1 Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

- .16 Duct Cleaning:
 - .1 Pull 300 mm long x diameter 6 mm less than internal diameter of duct wooden mandrel through each duct, immediately after placing of concrete.
 - .2 Then pull stiff bristle brush through duct; avoid disturbing or damaging ducts where concrete has not set completely.
 - .3 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .17 Install four 3 m lengths of 10M reinforcing rods, one in each corner of duct bank when connecting duct to manholes or buildings.
 - .1 Wire rods to 10M dowels at manhole or building and support from duct spacers.
 - .2 Protect existing cables and equipment when breaking into existing manholes.
 - .3 Place concrete down sides of duct bank filling space under and around ducts.
 - .4 Rod concrete with flat bar between vertical rows filling voids.
- .18 Install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.2 MARKERS

- .1 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run.
 - .1 Place concrete duct marker at ends of such duct runs.
 - .2 Construct markers and install flush with grade.
- .2 Mark ducts every 150 m along straight runs and changes in direction.
- .3 Where markers are removed to permit installation of additional duct, reinstall existing markers.
- .4 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.
- .5 Submit drawings showing locations of markers.

3.3 SITE QUALITY CONTROL

- .1 Site Tests/Inspections:
 - .1 Inspection of duct will be carried out by DCC Representative before placing.
 - .2 Placement of concrete and duct cleanout to be done when DCC Representative present.

3.4 CLEANING

- .2 Progress Cleaning, Final Cleaning and Waste Management as per Section 26 05
00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance Submittals: Submit in accordance with Section 26 05 00 Common Work Results for Electrical
 - .1 Certificates: Signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
 - .2 Manufacturer's Instructions: For installation and special handling criteria, installation sequence, and cleaning procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical
- .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 and return by manufacturer of pallets crates padding and packaging materials in accordance with Section 26 05 00 Common Work Results for Electrical.

Part 2 Products

2.1 PVC DUCTS AND FITTINGS

- .1 Rigid PVC Duct: Type DB2/ES2, with fabricated moulded fittings, for direct burial expanded flange ends, Trade size 6.
 - .1 Nominal Length: 3 m plus or minus 12 mm.
- .2 Rigid PVC split ducts.

.3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make a complete installation.

.4 Rigid PVC 90 degrees, 45 degrees bends and 5 degrees angle couplings as required.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

2.3 CABLE PULLING EQUIPMENT

.1 6 mm stranded nylon pull rope tensile strength 5 kN.

2.4 MARKERS

.1 Concrete type cable markers: as indicated, with words: "Cable", "Joint" or "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

.2 Cedar Post Type Markers: 89 x 89 mm square, 1.5 m long, pressure treated with colored, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing duct.

.1 Nameplate: Aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words "Cable" "Joint" or "Conduit" with arrows to indicate change in direction.

2.5 WARNING TAPE

.1 Standard 4-mil polyethylene 76 mm wide tape, yellow with black letters, imprinted with "CAUTION BURIED ELECTRIC CABLE BELOW".

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 duct in accordance with manufacturer's instructions and at elevations as indicated.

.2 Clean inside of ducts before laying.

.3 Install plastic duct spacers and ensure full, even support every 1.5 m and smooth transition throughout duct length.

.4 Slope ducts with 1 to 400 minimum slope.

- .5 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.
- .6 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign material.
 - .1 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 Install a pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Place continuous strip of warning tape 300 mm above duct before backfilling trenches.
- .9 Install markers as required.
- .10 Notify the DCC Representative for site review upon completion of direct buried ducts and obtain acceptance before backfilling.

3.3 CLEANING

- .1 Clean in accordance with Section 26 05 00 Common Work Results for Electrical.
- .2 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 26 05 00 Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 28 – Grounding - Secondary
- .3 Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 Common Work Results for Electrical
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance Submittals: Submit in accordance with Section 26 05 00 Common Work Results for Electrical
- .2 Regulatory Requirements:
 - .1 Perform Work to comply with applicable Provincial/Territorial regulations.
 - .2 Coordinate and meet requirements of power supply authority.
 - .1 Ensure availability of power when required.
- .3 Certificates: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
- .4 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 26 05 00 Common Work Results for Electrical
- .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 and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 26 05 00 Common Work Results for Electrical

Part 2 Products

2.1 MATERIALS

- .1 Underground ducts: rigid type DB2, size as indicated.
- .2 Rigid steel galvanized conduit and fittings: size as indicated.
- .3 Conductors: Copper, type RWU-90, size and number of conductors as indicated.
- .4 Meter Socket: as per approval of supply authority.
- .5 Concrete: To CSA A23.1/A23.2
- .6 Backfill: Clean and free of debris.
- .7 Pulling Iron:
 - .1 22 mm diameter hot dipped galvanized steel bar with exposed triangular shaped opening.

Part 3 Execution

3.1 INSTALLATION

- .1 Install cables in trenches and in ducts/conduit in accordance with Section 26 05 43.01 Installation of Cables in Trenches and in Ducts.
- .2 Allow adequate conductor length for connection to supply by power supply authority.
- .3 Install meter socket and conduit.
- .4 Allow adequate conductor length for connection to service equipment.
- .5 Make grounding connections in accordance with Section 26 05 28 Grounding - Secondary.
- .6 Install concrete encased ducts for electrical systems as indicated and in accordance with CSA A23.1.
- .7 Install pulling irons as required.
- .8 Seal ducts and conduits at building entrance location after installation of cable.

3.2 SITE QUALITY CONTROL

- .1 Site Tests:
 - .1 Perform tests in accordance with Section 26 05 00 Common Work Results for Electrical.

- .2 Perform additional tests if required by authority having jurisdiction.
- .2 Submit written test results to DCC Representative approval.

3.3 CLEANING

- .1 Clean in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 26 05 00 Common Work Results for Electrical

END OF SECTION