



# Issued for Tender

## Specifications | Devis

<b>Project Name   Nom du projet :</b>	Watermain Connections, Backflow Prevention and Metering
<b>DND Project File :</b>	N.200114.24.08.01
<b>DCC Project File :</b>	KN239913
<b>Drawing Number   Numéro du projet :</b>	K-B35-9304/27
<b>Date   Date :</b>	February 6, 2026
<b>Location   Emplacement :</b>	CFB Kingston
	Address   Adresse
	Kingston
	City   Ville
	ON
	Province   Province
<b>Project Manager   Chargé de projet :</b>	<div>HOGAN, COLIN 256</div> <div>Digitally signed by HOGAN, COLIN 256 Date: 2026.03.24 09:32:58 -04'00'</div> <div>Colin Hogan, Project Manager</div>
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K-B35-9304/27

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**Part 1      General**

**1.1      WORK COVERED BY CONTRACT DOCUMENTS**

- .1      Work of this Contract includes, but is not limited to, the furnishing of all labour, materials, equipment, testing, commissioning, and training required for watermain construction, valves, hydrants, backflow preventers, acid dosing system, site drainage, culverts, access roads, building construction, and associated electrical and mechanical supply and connections as indicated on the drawings and specification herein, located at CFB Kingston; and further identified as Watermain Connections - Backflow Prevention and Metering. Water meters will be supplied by Utilities Kingston, but their installation will remain with the Contractor.

**1.2      CODES**

- .1      Perform work in accordance with the National Building Code of Canada (NBC), Ministry of Labour guidelines and regulations, applicable codes and standards, and any other National Defence standard procedures that may be specified (all latest editions). In any case of conflict or discrepancy, the more stringent requirement shall apply.
- .2      Meet or exceed requirements of:
  - .1      Contract documents.
  - .2      Specified standards, codes, and referenced documents.
  - .3      All of the above documents are latest issue, regardless of data shown in the specification.

**1.3      DEFINITIONS**

- .1      DCC Representative is Defence Construction Canada Ltd. DCC, as referenced in DCC General Conditions. DCC is the tendering agency and the Coordinator for the projects. DCC is the sole project authority representing National Defence and the Designer of Record for the project, during and after tender award:
  - .1      DCC Representative is the sole project authority. The Designer of Record is to have the DCC Representative approval for making any changes to the design or specification.
  - .2      The Contractor shall cooperate fully with the DCC Representative order that the DCC Representative and the Designer of Record may properly review the progress of the work during its execution.

**1.4      SITE CONDITIONS AND INQUIRIES AT TENDER**

- .1      It is highly recommended that Contractors visit the site where possible to familiarize themselves with existing conditions and project intent during the tender. Bidders site briefing, if conducted, is not comprehensive and is not a substitute for a thorough review of the tender package by the Contractor.

## **1.5 SETTING OUT OF WORK**

- .1 Assume full responsibility for and execute complete layout of work to locations, lines, and elevations indicated.
- .2 Provide everything needed to lay out and construct work.
- .3 Supply any devices and or templates required to facilitate DCC Representative or authorized testing agencies inspection of work.
- .4 Location of non-base controlled services are the responsibility of the Contractor to obtain. These are typically natural gas, telephone, cable, and local utility controlled electrical. Base will locate services as follows: Base controlled electrical, sewer, steam, water, and communications.
- .5 Saturday and Sunday work or work on specified Statutory Holidays is NOT permitted unless approved by the DCC Representative.
- .6 Contractor is to provide a qualified and competent superintendent and is to be present at the job site when work is being performed.

## **1.6 WORK SEQUENCE**

- .1 Prior to making any excavations, all Work to be scheduled and coordinated with the DCC Representative.
- .2 Construct Work in stages to accommodate Owner's continued use of premises during construction, as applicable. Contractor shall make an effort to minimize disruption to the users and any operational impacts. Planning and coordination by the Contractor with DCC Representative and Utilities Kingston will be important.
- .3 Co-ordinate Progress Schedule with Owner Occupancy during construction.
- .4 Construct Work in stages to provide for continuous usage. Do not close off usage of facilities until use of one stage of Work will provide alternate usage:
  - .1 Access/egress - building operations are essential to the base and will be operational throughout construction. Contractor to ensure safe access and egress is maintained through the site and to the building throughout construction for building users.
- .5 Contractor to maintain a minimum 3.0 m wide lane, including overhead clearances, for emergency services access/egress. Where excavation at the entrance temporarily prohibits staged construction and typical access, steel crossing plates must be onsite as a provision.
- .6 For Sites #1 to #3, only one primary watermain can be taken out of service at one time. For example, if Site #1 is taken offline, Site #2 and #3 must remain operational.
- .7 The Contractor must sequence the Work to minimize down time and interruptions to Base water supply.
- .8 Reference Section 01 14 00 - Work Restrictions, paragraph 1.4.

## **1.7 CONTRACTOR USE OF PREMISES**

- .1 Use of DND Property:
  - .1 Contractor, Subcontractor(s), and all personnel of this contract shall not use any tools, equipment, materials, buildings, structures, or any other or any other

property owned, rented, or leased by the Department of National Defence (DND) unless authorized in writing by the DCC Representative.

.2 Contractor's Use of Site:

.1 Use of site: exclusive and complete for execution of work, within the boundaries of the Project area of work, unless otherwise stated in writing by the DCC Representative:

.1 Zones for exterior storage area are indicated or are as directed by the DCC Representative.

.3 Limit use of premises to allow:

.1 Partial owner occupancy.

.4 Co-ordinate use of premises under direction of DCC Representative.

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

.6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by DCC Representative.

.7 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

## 1.8 OWNER FURNISHED ITEMS (AS NEEDED)

.1 Contractor Responsibilities:

.1 Receive and unload products at site.

.2 Inspect deliveries jointly with DCC Representative; record shortages, and damaged or defective items. Inform DCC Representative immediately in writing of condition of items received.

.3 Handle products at site, including uncrating and storage.

.4 Protect products from damage, and from exposure to elements.

.5 Assemble, install, connect, adjust, and finish products.

.6 Repair or replace items damaged by Contractor or subcontractor on site (under his control).

## 1.9 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 recommendation for safety, assess, and maintenance. Advise DCC Representative of conflicts and await clarification.

.3 Inform DCC Representative of impending installation and obtain their approval for actual location.

.4 Submit red line drawings to indicate relative position of various services and equipment.

**1.10 CONCEALMENT**

- .1 Conceal pipes, duct, and wiring in the floor, wall, and ceiling construction of finished areas except where indicated otherwise.

**1.11 CUTTING AND PATCHING**

- .1 Cut and patch as required to make work fit. Refer to appropriate sections and details. Where no detail is given advise DCC Representative and wait for direction.
- .2 Make cuts with clean, true, and smooth edges.
- .3 Where new work connects with existing and where existing work is altered, cut, patch, and make good to match existing work or as indicated.

**1.12 ADDITIONAL DRAWINGS**

- .1 DCC Representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in Contract documents.

**1.13 RELICS AND ANTIQUITIES**

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

**1.14 ALTERATIONS, ADDITIONS, OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public, and normal use of premises. Arrange with DCC Representative to facilitate execution of work.

**1.15 EXISTING SERVICES**

- .1 Notify DCC Representative of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give DCC Representative 5 working days' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by DCC Representative with minimum disturbance to pedestrian, vehicular traffic, and tenant operations.
- .3 Provide alternative routes for personnel, pedestrian, and vehicular traffic.
- .4 Submit schedule to and obtain approval from DCC Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .5 Provide temporary services when directed by DCC Representative to maintain critical building and tenant systems.

- .6 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .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, notify DCC Representative.
- .9 Record locations of maintained, re-routed, and abandoned service lines on redline drawings.
- .10 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

#### **1.16 DOCUMENTS REQUIRED**

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

#### **1.17 QUALITY ASSURANCE**

- .1 The review of the work by the DCC Representative is to confirm adherence to the intent of the design. It does not release the Contractor from their responsibility for the proper execution of the work in accordance with the drawings and specifications and all governing regulations and good workmanship and established trade practices.
- .2 The sampling inspection of material installations by testing agencies will not release the Contractor from his responsibility for the thorough execution of the work in accordance with the drawings and specifications and all governing regulations, good workmanship, and established trade practices.
- .3 The intermittent site reviews and subsequent reports by the Designer of Record do not constitute thorough inspection, blanket approval or comprehensive deficiency findings of the installations performed by the Contractor. They are limited to what has been witnessed and to establish adherence to the intent of the design. The Contractor is responsible for the proper execution of the work in accordance with the drawings and

specifications and all governing regulations, good workmanship, and established trade practices.

- .4 The Contractor is responsible for securing timely written clarifications where the intent of the design may not be clear.

#### **1.18 COST BREAKDOWN**

- .1 Within 10 working days of award submit breakdown of Contract price in detail as directed by DCC Representative and aggregating contract price. Cost breakdown will be used as basis for progress payment.
- .2 Itemized separate line cost for each of the following general cost items as applicable:
  - .1 Performance and Payment Bonds.
  - .2 Field supervision and layout.
  - .3 Temporary Facilities and Controls.
- .3 Itemize separate line item cost for work required by each Section of this Specification.

#### **1.19 PROJECT MEETINGS**

- .1 Hold construction project meetings at times and locations approved by DCC Representative:
  - .1 For bidding purposes, assume Project Meetings to be held bi-weekly.
- .2 DCC Representative will advise General Contractor of meetings. General shall be responsible for notifying Subcontractors and any other interested parties whose attendance is required.
- .3 DCC Representative will assume responsibility for recording and distributing minutes to all interested parties.

#### **Part 2 Products**

##### **2.1 NOT USED**

- .1 Not Used.

#### **Part 3 Execution**

##### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1            ACCESS AND EGRESS**

- .1      Design, construct, and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, and scaffolding as required, independent of finished surfaces and in accordance with relevant Municipal, Provincial, and other regulations.

**1.2            USE OF SITE AND FACILITIES**

- .1      Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with DCC Representative to facilitate work as stated.
- .2      Maintain existing services to building and provide for personnel and vehicle access.
- .3      DCC Representative may, at their sole discretion assign sanitary facilities for use by Contractor's personnel. Keep facilities clean. For bidding purposes, assume that the Contractor provides sanitary facilities.
- .4      Closures: protect work temporarily until permanent enclosures are completed.

**1.3            ALTERATIONS, ADDITIONS, OR REPAIRS TO EXISTING BUILDING**

- .1      Execute work with least possible interference or disturbance to building operations, occupants, and normal use of premises. Arrange with DCC Representative to facilitate execution of work.

**1.4            SPECIAL REQUIREMENTS**

- .1      Carry out Work Monday to Friday from 0700 to 1700, except when other hours are approved by DCC Representative. No work on statutory holidays unless approved by DCC Representative.
- .2      Interruptions and connections to the CFB Kingston Steam network will only be allowed during the period of June 1<sup>st</sup> to September 30<sup>th</sup>, unless directed otherwise by the DCC Representative.
- .3      Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic, and security regulations.
- .4      Keep within limits of work and avenues of ingress and egress.
- .5      Hydro-vacating or hand-digging to occur for all excavation within 1 m of existing gas infrastructure or other underground infrastructure.
- .6      When directed to do so by DCC Representative and before commencing work within 3 m of gas main, Contractor to provide 72 hour notice to Enbridge Planning and Dispatch group at 1-855-228-8757, as well as RP Ops Shops.
- .7      Contractor shall coordinate utility connections with the DCC Representative. DCC Representative to coordinate with Utilities Kingston. Provide minimum 5 days' notice to DCC Representative.
- .8      Refer to the construction sequencing plans for recommendations on water valve turning procedures. These guidelines serve as general advice. If the Contractor identifies an



optimized shutdown aligned with their construction schedule, they may submit an alternative plan after award to the DCC Representative for approval.

**1.5 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions. Smoking is not permitted.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by DCC Representative are specified under sections as applicable.

**1.2 APPOINTMENT AND PAYMENT**

- .1 DCC Representative will appoint and pay for services of testing laboratory except follows:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Testing, adjustment, and balancing of conveying systems, mechanical and electrical equipment, and systems.
  - .4 Mill tests and certificates of compliance.
  - .5 Tests specified to be carried out by Contractor under supervision of DCC Representative.
  - .6 Additional tests specified in paragraph 1.2.2.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by DCC Representative to verify acceptability of corrected work.

**1.3 CONTRACTOR'S RESPONSIBILITIES**

- .1 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.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**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      Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .3      Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days.
- .4      Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .5      Milestone: significant event in project, usually completion of major deliverable.
- .6      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.
- .7      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 Project Schedules are practical and remains 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 Award of Contract, Interim Certificate, and Final Certificate dates are identified on the schedule.

**1.3                ACTION AND INFORMATIONAL 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, a detailed Project Schedule, capable of identifying, scheduling, monitoring, and reporting activities related to the progress of work. Provide sufficient detail and degree of control in the schedule to the approval of the DCC Representative and such that the needs and objectives of the Contract are met.

**1.4                PROJECT MILESTONES**

- .1      Project milestones form interim targets for Project Schedule. Contractor to identify milestones on project schedule. Contractor to include identified milestones from Tender Documents on Project Schedule.

## **1.5 PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Identification of work periods on a horizontal time scale, from date of award to completion. Indicated weekend or after hours work, if required.
  - .2 Submission date, review times for shop drawings, product data, and samples.
  - .3 Anticipated progress of the work for each major activity by discipline. Duration of each task shall be a maximum of 10 days.
  - .4 Identification of the most critical activities throughout the course of the project.
  - .5 Major equipment/material deliveries.
  - .6 Backfill of any utilities.
  - .7 Planned shutdowns of existing systems for work requirements.
  - .8 Proposed dates(s) for commissioning, if required.
  - .9 Training for personnel on new systems.
  - .10 Submission of Redline Drawings, updated Record Drawings, and Operations and Maintenance Manuals.
  - .11 Mobilization and demobilization.
- .3 DCC Representative will review schedule and return review copy with comments or request for clarifications within 10 business days after receipt.
- .4 Submit finalized schedule within 10 business days after return of review copy.

## **1.6 PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on monthly basis reflecting activity changes and completions, as well as activities in progress.

## **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.
- .2 Submit progress update of activities against planned progress on a bi-weekly basis as requested by the DCC Representative. Progress update to reflect the next 2 weeks of work.
- .3 Weather related delays with their remedial measures will be discussed and negotiated.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                ADMINISTRATIVE**

- .1      This Section specifies general requirements and procedures for Contractor submissions of shop drawings, product data, samples, mock-ups, and certificates to DCC Representative for review. Additional specific requirements for submissions are specified in individual Sections of the specification.
- .2      Submit to DCC Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .3      Do not proceed with Work affected by submittal until review and acceptance by the DCC Representative.
- .4      Present shop drawings, product data, samples, and mock-ups in SI Metric units.
- .5      Where items or information is not produced in SI Metric units converted values are acceptable.
- .6      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 coordinated with requirements of Work and Contract Documents. Submittals not dated and identified as to specific project will be returned without being examined and considered rejected.
- .7      Notify DCC Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8      Verify field measurements and affected adjacent Work are coordinated.
- .9      Contractor's responsibility for errors and omissions in submission is not relieved by DCC Representative's or Designer of Record review of submittals.
- .10     Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by DCC Representative or Designer of Record review.
- .11     Submitted shop drawings that do not consider the time requirement for review and or the time required to order, manufacture, and deliver does not constitute justification or grounds for requesting an alternate material that is readily available for the project. Contractor shall bear all costs associated to provide the acceptable product to deliver the project on schedule.
- .12     Keep one reviewed copy of each submission on site.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1      The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2      Indicate materials, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or

equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .3 Allow 10 working days for DCC Representative's review of each submission.
- .4 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.
- .5 Accompany submissions with transmittal letter, containing:
  - .1 Date.
  - .2 Project Title and Building Number.
  - .3 DND Drawing Number.
  - .4 DND Project Number.
  - .5 DCC Project Number.
  - .6 Contractor's name and address.
  - .7 Identification and quantity of each shop drawing, product data, and sample.
  - .8 Other pertinent data.
- .6 Submissions include:
  - .1 Date and revision dates.
  - .2 Project Title and Building Number.
  - .3 DND Drawing Number.
  - .4 DND Project Number.
  - .5 DCC Project Number.
  - .6 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .7 Signature by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .8 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.
- .7 After DCC Representative's review, distribute copies.
- .8 Submit one electronic copy of shop drawings for each requirement requested in specification Sections and as DCC Representative may reasonably request.
- .9 Submit electronic copy 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.
- .10 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by DCC Representative:
  - .1 Report signed by authorized official of testing laboratory that material, product, or system identical to material, product, or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been within 3 years of date of contract award for project.
- .11 Submit electronic copy 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.
- .12 Submit electronic copy of manufacturer's 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.
- .13 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by DCC Representative.
- .14 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .15 Submit electronic copy 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, electronic acceptance copy 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.



### **1.3 SAMPLES**

- .1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to DCC Representative.
- .3 Notify DCC Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern, or texture is criterion, submit full range of samples.
- .5 Make changes in samples which DCC Representative may require, consistent with Contract Documents.
- .6 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

### **1.4 MOCK-UPS**

- .1 Erect mock-ups in accordance with Section 01 45 00 - Quality Control.
- .2 Reviewed and accepted mock-ups will become standard of workmanship and materials against which installed work will be verified.
- .3 Erect mock-ups at locations acceptable to DCC Representative.

### **1.5 PHOTOGRAPHIC DOCUMENTATION**

- .1 When called for inspections submit electronic copy of colour digital photography in .jpg format, standard resolution, and as directed by DCC Representative.
- .2 Project identification: name and number of project and date of exposure indicated.

### **1.6 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**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 1.8.
  - .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 the 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 than 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 °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 the 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 15 m 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 20 lbs. 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 personnel. This includes:
  - .1 Phased new construction.
  - .2 Early or partial occupancy of new construction.
  - .3 New construction being added onto an existing building.
  - .4 Renovation or recapitalization of an existing building.
  - .5 Phased renovation or recapitalization of an existing building.
- .2 Where partial occupancy occurs, Contractor shall implement requirements as found in the drawings and specifications. This may include construction of a rated fire separation between occupied and construction areas as required by the National Fire Code.
- .3 A watch, with tours at intervals of not 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.

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**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.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



## Part 1 General

### 1.1 REFERENCES

#### .1 Federal:

.1 Applicable Base Standing Orders (BSOs) will be provided to the Contractor after award:

- .1 Directorate Contaminated Sites (DCS) Contaminated Sites Instruction (CSI.004.001) - Soil Management. V. 4.3, 22 October 2025.
- .2 BSO 16.01 - Emergency Environmental Response.
- .3 BSO 16.02 - Environmental Impact Assessments.
- .4 BSO 16.04 - Halocarbon Management - Infrastructure.
- .5 BSO 16.06 - Hazardous Materials General Requirements.
- .6 BSO 16.07 - Disposal of Hazardous Materials Waste.
- .7 BSO 16.08 - Waterbody Activities.
- .8 BSO 16.10 - Natural Resources.
- .9 BSO 16.11 - Archaeological Resources.
- .10 BSO 16.12 - Soil Management.

.2 Canadian Council of Ministers of the Environment (CCME). *Canadian Environmental Quality Guidelines*.

.3 *Canadian Environmental Protection Act 1999*. Statutes of Canada 1999 Chapter 33:

.1 Federal Halocarbon Regulations, 2022. SOR/2022-110.

.4 *Canadian Occupational Health and Safety Regulations* (SOR/86-304). Canada Labour Code.

.5 *Fisheries Act*. Revised Statutes of Canada 1985, Chapter F-14.

.6 *Migratory Birds Convention Act, 1994*.

.7 *Transportation of Dangerous Goods Act* and pursuant regulations.

#### .2 Provincial:

.1 *Ontario Water Resources Act*. Revised Statutes of Ontario 1990, Chapter O.40:

.1 Ontario Regulation 903. *Wells*.

.2 *Technical Standards and Safety Act, 2000* and Pursuant Regulations, Codes, and Standards. Statutes of Ontario 2000, Chapter 16.

.3 *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, as amended.

.2 Ontario Regulation 347. *General—Waste Management*. Revised Regulations of Ontario 1990.

.3 Ontario Regulation 406/19. *On-site and Excess Soils*.

- .4 *Occupational Health and Safety Act*. Revised Statutes of Ontario 1990, Chapter O.1:
  - .1 Ontario Regulation 490/09. *Designated Substances*.
  - .2 Ontario Regulation 278/05. *Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations*.
- .5 Ontario Ministry of Labour. 2011. *Silica on Construction Projects*.
- .6 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.
- .3 Municipal:
  - .1 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*”.
  - .2 City of Kingston By-Law No. 2004-52 “*A By-Law to Regulate Noise*”.

## 1.2 RELATED SECTIONS

- .1 Section 01 35 43.01 - Environmental Protection - Soil Management.

## 1.3 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):
    - .1 Provide Monthly Inspection Reports.
  - .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.

#### 1.4 DESIGNATED SUBSTANCES

- .1 In accordance with Section 30 of Ontario's *Occupational Health and Safety Act*, following is a list of designated substances present at the project site:
  - .1 Lead may be present in existing infrastructure, i.e. solders, joints, and plumbing:
    - .1 Disturbances to lead and lead painted surfaces shall be conducted in accordance with the Ministry of Labour, Immigration, Training and Skills Development (2022). *Lead on Construction Projects*. Government of Ontario.
  - .2 For bidding purposes, if lead waste cannot be recycled then lead-containing wastes are to be assumed leachate toxic, and will be transported and disposed of as hazardous waste regular waste.
  - .3 Silica is present in all concrete materials throughout the project site:
    - .1 Disturbance of materials containing silica shall be conducted in accordance with the Ministry of Labour Guidelines "*Silica on Construction Projects*" (2011).
- .2 Inform all workers and sub trades of the presence of designated substances and hazardous materials identified in the contract documents.
- .3 Immediately notify the DCC Representative of potential Asbestos Containing Material (ACM) discovered during the work and not apparent from the drawings, specifications, or reports pertaining to the Work. Do not disturb such material.

#### 1.5 GENERAL

- .1 Comply with all Federal, Provincial, and Municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, including in Section 1.1 - 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 No fixed or temporary fuel storage tanks are permitted.
- .10 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.

## 1.6 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 1.6.6 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 A CFB Kingston Pollution Incident Report Template 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.
- .8 The Contractor will be provided a Contractor Environmental Hazard & Spill Response Guide by DCC which shall be posted at the Work Site.

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

## **1.8 HAZARDOUS MATERIALS ABATEMENT AND MANAGEMENT PLAN**

- .1 Prior to work onsite Contractor to create and submit to the DCC Representative a Hazardous Materials Abatement and Management Plan (HMAMP).
- .2 The HMAMP will address the details of how designated substance(s) and hazardous material(s) will be abated and managed. HMAMP to include:
  - .1 Name and contact information of:
    - .1 The designated qualified individual to be the Environmental Protection Coordinator (EPC).
    - .2 All Subcontractors who will support the HMAMP.

- .2 A list of all Municipal, Provincial, and Federal permits and notifications required to complete the Work.
- .3 A list of all hazardous materials to be brought to site.
  - .1 Include volumes and SDS, copy of placards and signage.
- .4 Detail the approach to the execution of abatement work, including the equipment, tools, materials, and actions to be employed for each type of designated substance or hazardous material.
- .5 Identify number of calendar days for the shutdown of any building systems (e.g. HVAC, fire alarms, etc.).
- .6 Detailed emergency procedures to be followed in the event of: fire, breach of the enclosure, injury or accident within the enclosure, detection of airborne asbestos fibers outside the enclosure, spilling asbestos debris or other designated substance on route to the waste bin.
- .7 If not defined in other plans, provide details of waste disposal procedures for materials stored, used, or abated including locations on the work site.
- .3 Inform all workers and sub trades of the presence of designated substances and hazardous materials identified in the contract documents.
- .4 Immediately notify the DCC Representative of potentially containing asbestos material discovered during the work and not apparent from the drawings, specifications, or reports pertaining to the Work. Do not disturb such material.
- .5 Fire alarm suspension can be coordinated on weekdays between 7:30 am and 3:30 pm daily:
  - .1 Notification to DCC Representative, via submission of completed Request for Fire Alarm Shut Down form, is required a minimum of 5 days in advance of temporary fire alarm shut down.
- .6 Written notification to DCC Representative required a minimum of 5 days prior to request to disable the mechanical ventilation system servicing the work area.

## **1.9 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:
  - .1 Regular waste,
  - .2 Construction waste,
  - .3 Hazardous materials used in the course of the work,
  - .4 Hazardous materials and designated substance waste, and
  - .5 The WMPD shall include items below in addition to Section 1.10:
    - .1 Name and contact information for the individual designated by the Contractor to be the Environmental Protection Coordinator (EPC).
    - .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.
- .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 kept neat and orderly at all times.
- .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:
    - .1 Record the weight of leachate toxic material sent for 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 #20 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 Control 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.

## **1.10 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 The Contractor is to replace trees that have been removed by others in support of this project in accordance with Section 32 93 10 - Trees, Shrubs & Ground Cover Planting, as well as to the following:
  - .1 At a minimum, planting two (2) replacement trees for each tree that was removed. Assume eight (8) trees have been removed previously.
  - .2 Tree species must be native to Ontario. Review the species selections with DCC Representative prior to planting.
  - .3 Size shall be not less than 5 cm caliper trees.
  - .4 The specific location and site of the trees will be determined after award.
- .9 The Contractor is not permitted to fell or limb any Trees.
- .10 Trees labeled in blue paint or numbered are not to be cut down or removed. If encountered, the Contractor is to stop work and notify the DCC Representative immediately.

## **1.11 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; and

- .2 Depending on the nest and bird species, setbacks for disturbance zones maybe defined.
- .2 The Contractor will comply with the *Migratory Birds Convention Act*, 1994.
- .3 Prior to work commencing, conduct ground surveys to ensure that wildlife are not nesting/denning on or immediately adjacent to the project site:
  - .1 Where found, immediately notify the DCC Representative; and
  - .2 Maintain a minimum setback distance of 3 m from wildlife burrows/dens and maintain markers indicating wildlife burrows/dens.

#### **1.12 SOIL MANAGEMENT**

- .1 Refer to Section 01 35 43.01 - Environmental Protection - Soil Management.

#### **1.13 POLLUTION PREVENTION - WATER**

- .1 Protection of Storm Drains:
  - .1 Protect storm drains within work site and within roadway that borders work site (which may be outside of work site) against entry by sediment, debris, oil, or chemicals prior to any work on-site and maintain until completion of work.
  - .2 Discharge of sediment-laden water to storm sewer is not permitted.
  - .3 Catch basins and catch basin manholes within work site and within roadway that borders work site (which may be outside of work site) to have a double layer of geotextile placed under lids to prevent sedimentation of storm sewer system. The geotextile shall be maintained until the completion of work.
  - .4 Ditch inlets to be protected by flow check dam immediately upstream of ditch inlet until all areas draining into the ditch inlet have been permanently stabilized.
- .2 Protection of Drinking Water:
  - .1 In the event of a water main break, leak, or disruption, Contractor is to stop work and notify the DCC Representative immediately.
  - .2 Water mains are to be disinfected with a 12% solution of sodium hypochlorite specific for drinking water supplies.
  - .3 Coordinate with DCC Representative to have the Department of National Defence's water authority; Water, Fuel and Environment (WFE) witness the connection, disinfection and flushing procedures as well as collect residual chlorine and bacteria samples.
  - .4 Repeat disinfection procedure of water main as required in order to achieve acceptable test results.
- .3 Protection of Groundwater Monitoring Wells:
  - .1 There are no known wells within the vicinity of the Work Sites.
  - .2 Protect any and all existing groundwater monitoring wells at the site, if discovered.
  - .3 The Contractor is responsible to repair any damage to existing monitoring wells. Work is to be completed in compliance with Ontario Regulation 903, but not registered with the Province.

- .4 Protection of Waterbodies:
  - .1 Do not operate construction equipment in waterways.
  - .2 Do not use waterway beds for borrow material.
  - .3 Do not dump excavated fill, waste material, or debris in waterways.
  - .4 Chlorinated drinking water is considered a deleterious substance by Environment and Climate Change Canada (ECCC).
  - .5 Contractor is to ensure that hydrant discharge does not enter or is likely to enter fish habitat by direct or indirect discharge with measurable levels of free reactive chlorine (CCME).
  - .6 Discharging to land is permitted subject the use of matting to prevent loss of soil or vegetation ensuring that items above are complied with.

#### **1.14 POLLUTION PREVENTION - LAND**

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

## **1.15 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, and engine covers.
- .3 Comply with operating specifications for heavy equipment and machinery.
- .4 Minimize the operation and idling of vehicles and avoid operating and idling vehicles and gas-powered equipment during smog advisories.
- .5 Control emissions from equipment and plant to conform with Federal, Provincial, and Municipal requirements.
- .6 Products and Materials:
  - .1 Use products and materials that are as free as possible of noxious or toxic volatile emissions or emissions of irritating or toxic particles, so that the interior air of the completed building is as pollution-free as possible. For example, products emitting benzene, mercury, lead, or other known toxic compounds are not acceptable.
  - .2 Where odourless products are not available, choose products where possible so that odours are minimized. Set ventilation levels during the construction period sufficiently high to encourage the off-gassing of materials to their minimum levels prior to occupancy of the building, where possible.
  - .3 Choose products for installation within the air-handling and distribution systems to minimize the introduction of pollutants into the fresh air supply to the building.
  - .4 Remove oily rags and other combustible debris from Site daily. Take every precaution necessary to prevent spontaneous combustion.

## **1.16 ARCHAEOLOGY**

- .1 The Work Sites have been identified as having archaeological significance. Site 1, 2, 3, and 4b have undergone archaeological investigations facilitated through DCC which found no artifacts or features of cultural significance at the Work Sites (Site 1, Site 2, Site 3, and Site 4b).
- .2 Soil disturbances to native soils are not permitted outside the scope of work area. This does not include soils that are considered fill which are associated with existing infrastructure.
- .3 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.
- .4 During excavations, watch for the following: patterns; off-colour soils (either light or dark); any sorts of the artifacts noted above.
- .5 Upon discovery of artifacts, stop work in that area and notify the DCC Representative.

- .6 An archaeologist licensed in the Province of Ontario, Canada will be provided through DCC for any monitoring or additional assessment for areas that are not already assessed. For bidding purposes assume no additional archaeological monitoring or assessment will be required.
- .7 The DCC Representative is to be immediately notified if excavations are to occur outside of the original scope.

#### **1.17 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 the Contractor.
- .5 The following are the only halocarbons that are acceptable as refrigerants (non-halocarbon refrigerants are also acceptable):
  - .1 HFC R32.
  - .2 HFC 410A.
  - .3 HFC 134A.
  - .4 HFC 404A.
  - .5 HFC/HFO R454B.
- .6 Document all work-installation, maintenance, decommissioning, and leak testing on refrigeration and air conditioning systems using a CFB Kingston Refrigeration and Air Conditioning Service Log form. 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 Halocarbon Incident Release Form found in subsection 1.19 and provide to DCC Representative within 24 hours.
- .9 Leak-test all halocarbon-containing equipment with a capacity equal to or greater than 10 kg within 24 hours of arrival at the Base, in accordance with the FHR 2022 and the Refrigeration Code of Practice.
- .10 Leak-test “empty” equipment with a capacity equal to or greater than 10 kg 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.
  - .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.
  - .13 Comply with the following timelines for service activity log completions:
    - .1 Factory charged units containing more than 10 kg of halocarbon shall have leak tested service logs submitted to DCC 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; and
    - .8 Decommissioning of units requires forms to be submitted to DCC Representative within 48 hours of service.
  - .14 Example Refrigeration and Air Conditioning Service Log form is provided in subsection 1.18 below (hard copies for contractual submission will be provided after award).



1.18

REFRIGERATION AND AIR CONDITIONING SERVICE LOG

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 6, 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.** ☐ Commissioning ☐ Leak Test ☐ Servicing ☐

Decommissioning

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 <input type="checkbox"/> FIELD <input type="checkbox"/>

**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

**1.19 HALOCARBON INCIDENT RELEASE FORM**

RELEASE REPORTING FORM FOR HALOCARBON REFRIGERATION, AIR CONDITIONING,  
FIRE EXTINGUISHING AND SOLVENT SYSTEMS

TO BE COMPLETED WITHIN 24 HOURS OF OCCURRENCE

Owner \_\_\_\_\_

Building No. \_\_\_\_\_

Room No. \_\_\_\_\_

Operator \_\_\_\_\_

Type of System\* \_\_\_\_\_

Barcode No. \_\_\_\_\_

Serial No. \_\_\_\_\_

Type of Halocarbon Released \_\_\_\_\_

Estimated Quantity Released \_\_\_\_\_ (kg) (lb) (oz)

Circumstances of Release \_\_\_\_\_

Date Release Detected \_\_\_\_\_

Corrective Action Taken \_\_\_\_\_

Actions to Prevent Subsequent Release \_\_\_\_\_

Release Reported YES NO

Date And Time Release Reported \_\_\_\_\_

Release Reported to \_\_\_\_\_ Phone No. \_\_\_\_\_

Title \_\_\_\_\_

\* Type of system: Refrigeration Air Conditioning Fire Extinguishing Solvent System Other

Name \_\_\_\_\_

Title \_\_\_\_\_

Signature \_\_\_\_\_

**Submit form to DCC Representative**

**1.20 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**

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 Federal:
  - .1 Applicable Base Standing Orders (BSOs) will be provided to the Contractor after award:
    - .1 DCS CSI (CSI.004.001) - Soil Management. V. 4.2, October 22, 2025.
    - .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.
- .2 Provincial:
  - .1 *Aggregate Resources Act*, R.S.O. 1990, c. A.8.
  - .2 *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. As Amended.
    - .2 Ontario Regulation 347. *General-Waste Management*. Revised Regulations of Ontario 1990.
    - .3 Ontario Regulation 406/19. *On-site and Excess Soil Management*.
  - .3 Landscape Ontario Horticultural Trades Association 2004 (LOHTA 2004). *Landscape Guidelines, 2004 Edition - Chapter 5 Topsoil Guidelines*.
  - .4 Ontario Ministry of Transportation. *Ontario Provincial Standard Specifications (OPSS)*. Technical Publications.
  - .5 *Ontario Water Resources Act*. Revised Statutes of Ontario 1990, Chapter O.40.
  - .6 *Technical Standards and Safety Act, 2000* and pursuant regulations, codes, and standards. Statutes of Ontario 2000, Chapter 16.
  - .7 MECP Rules for Soil Management and Excess Soil Quality Standards.

### **1.2 RELATED SECTIONS**

- .1 Section 01 35 43 - Environmental Protection.

### **1.3 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 1.5 for minimum mandatory contents of the SMP:
    - .1 As part of the SMP, the Contractor is required to submit a Soil Sampling Plan.
- .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 Submit other data, information, and documentation upon request by the DCC Representative and as stipulated elsewhere in this section.
- .6 All soil movement on 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.

#### **1.4 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 1.1 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.

#### **1.5 MINIMUM SOIL MANAGEMENT PLAN (SMP) REQUIREMENTS**

- .1 The SMP will include soil characterization, soil quantities, considerations for water table excavations, disposal options for excess soil, stockpile locations and management plan, decontamination procedures, and soil re-use plan:
  - .1 Depending on Site conditions the Contractor may be required to submit a separate dewatering plan.

**.2 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 Subcontractor/consultant contact information to support the SMP.
- .3 SMP to be signed by the Qualified person.
- .4 Provide a drawing or figure showing the location for any soil movement on the work site. This includes stockpiling of soil, imported fill backfilling and excess soil for removal from site.

**.3 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 a description of the type of imported material (Granular A, stone dust, crusher run, etc.):
  - .1 Include sieve analysis showing less than 20% fines (if requesting exemption from testing) and proposed estimated quantity for each type of material.
- .3 In cases where fill material is not exempt from environmental characterization, 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.

**.4 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, and 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 disposed of from the Site. Include:
  - .1 The number of samples 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.
- .5 **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, or contaminated).
- .6 **Soil Sampling Plan to include:**
  - .1 The name of the licensed/permitted Source Site and Receiver Site from which the material will be provided.
  - .2 Description of the type imported material (aggregate, fill) and proposed quantity.
  - .3 The estimated volume of soil to be reused at the Work Site.
  - .4 The estimated volume of soil to be excess soil generated at the Work Site.
  - .5 The number of samples required to meet the provincial and federal guidelines on soil imports, reuse, and/or excess soil.
  - .6 The parameters that will be used to characterize the material.
  - .7 All samples shall be submitted to a Canadian Association for Laboratory Accreditation (CALA) or similar accredited laboratory for analysis.

## 1.6 MANAGEMENT OF REUSE AND EXCESS SOIL

- .1 Preliminary soil characterization for each Work Site (Site 1, Site 2, Site 3, and Site 4b) was completed for this project. The Contractor is to review the following Geotechnical Investigation Reports which are provided in Appendix A:
  - .1 Engineering Consulting Services Geotechnical Investigation Report Canadian Forces Base (CFB) Kingston, ON. (Site-1) prepared by Egis Canada Limited dated March 19, 2024.
  - .2 Engineering Consulting Services Geotechnical Investigation Report Canadian Forces Base (CFB) Kingston, ON. (Site-2) prepared by Egis Canada Limited dated March 15, 2024.
  - .3 Engineering Consulting Services Geotechnical Investigation Report Canadian Forces Base (CFB) Kingston, ON. (Site-3) prepared by Egis Canada Limited dated March 21, 2024.



- .4 Engineering Consulting Services Geotechnical Investigation Report Canadian Forces Base (CFB) Kingston, ON. (Site-4) prepared by Egis Canada Limited dated March 22, 2024:
  - .1 Note the above report does not encompass the Work Site known as 4b but has been included for general reference.
- .2 For bidding purposes, until soil characterization has been fully completed by the Contractor, they are to assume existing soil is non-hazardous and meets CCME Commercial land use standards, the Site Condition Standards (SCS).
- .3 Soil Characterization of the Work Sites will be completed by the Contractor for all excess soil or soil reused at the Work Sites. Assume that soil excavated from the project meets the SCS and can be reused where required as per the Contract plans and specifications.
- .4 The Contractor is to incorporate past environmental soil characterization contained in these contract documents into future characterization.
- .5 Based on the past environmental soil characterization for each Work Site, the following is known:
  - .1 Laboratory analysis of Petroleum Hydrocarbons (PHC), Benzene, Toluene Ethylbenzene, and Xylene (BTEX), Volatile Organic Compounds (VOC), Polycyclic Aromatic Hydrocarbons (PAHS), metals, and inorganic were completed on a limited number of samples:
    - .1 Site 1 samples satisfied table 2.1 - Agricultural and Other Uses.
    - .2 Site 2 samples satisfied table 2.1 - Industrial/Commercial/Community Property Use.
    - .3 Site 3 samples satisfied table 2.1 - Agricultural and Other Uses.
    - .4 Site 4b - not characterized.
  - .2 Soil leachate samples for toxicity characteristic leaching procedure (TCLP) analyses concluded for Site 1, Site 2 and Site 3 show soil should be classified as non-hazardous solid waste if disposed.
  - .3 The contractor is required to complete leachate testing as per O. Reg. 347 for soil that is suitable for landfill disposal. For bidding purposes assume Site 4b will require leachate testing to determine landfill suitability. Assume the soil at Site 4b is non-leachate toxic.
- .6 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.
- .7 Excavated materials leaving the Work Site must be sampled by the Contractor and disposed of in accordance with provincial and Federal standards:
  - .1 Parameters for excavated soil to be sampled are defined in Section 1.9 of this specification. These parameters will be used for reuse of soil on the Work Site or disposal offsite.
  - .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.

- .8 All temporary stockpiled soil must be placed on an impermeable surface and covered with an impermeable, properly secured tarp:
  - .1 Temporary storage must be at least 30 meters away from 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.
- .9 Prevent disturbance and compaction of topsoil and underlying soil from vehicles and heavy equipment using load dispersion materials.

#### **1.7 HYDROVAC/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 its generated, then it must be temporarily stored in drums, tested, then disposed of according.

#### **1.8 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 less otherwise exempt. These materials must be from a virgin source and not be recycled for an exemption to occur. Dependent on the source site the Contractor may request an exemption for the following:
  - .1 Imported fill less than 10 m<sup>3</sup>;
  - .2 Gravel/aggregates larger than 2 mm (i.e. does not pass a US #10 sieve);
  - .3 Fines and materials generated by the mechanical activity of crushing virgin rock (i.e. crusher dust); or
  - .4 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, or already characterized, 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 5.3.3, stating that the imported fill material meets CCME Agricultural Land use criteria or acceptable ambient background conditions based on intended use.
- .7 Topsoil shall be fertile, friable, sandy loam topsoil as defined in ***Chapter 5 Landscape Guideline: Landscape Ontario Horticultural Trades Association (LOHTA), 2004***. A mixture of subsoil and shall be free of stone 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 shall have a salt conductivity of less than 2 millisiemens/cm.
- .9 Soil Amendments shall 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 should meet the mechanical analysis as set out in Table 5-2 (LOHA 2004).
- .11 The 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 are met for low level maintenance, as outlined in Table 5-1 Properties of Growing Medium, LOHTA, 2004, prior to bringing topsoil to site. The Contractor is required to provide information 10 business days prior to bringing to site:

.1 Table 5-1:

Texture	Canadian System of Soil Classification Diameter (mm)	Sandy Loam to Loam Low Level Maintenance
Coarse Gravel	19 - 40	0 - 3%
All Gravel	2 - 40	0 - 10%
Sand	0.2 - 2	0 - 52%
Silt	0.002 - 0.5	0 - 50%
Clay	<0.002	0 - 27%
Clay and Silt		Max. 48%
Organic Matter		5 - 10%
Acidity pH		6.0 - 7.0

## 1.9 SAMPLING AND TEST RESULTS

- .1 Soil testing shall be conducted for imported fill, soil reuse on site, and excess soil taken off-site to identify soil quality conditions.
- .2 As part of the SMP, the Contractor is required to submit a Soil Sampling Plan that will detail the sampling and characterization of any excess soil to determine the location and concentration of contaminants to be removed from or imported to the work site that has not already been characterized within the contract documents:
  - .1 See Section 1.5.6 for minimum, mandatory Soil Sampling Plan content.
- .3 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.
- .6 Per- and polyfluoroalkyl substances (PFAS) for soil reuse, export and for soil imports if the source site has a history of airport or firefighting training activities:
  - .1 Site 3 requires PFAS to be included for soil characterization.
  - .2 Sampling for PFAS is to include all parameters for which there are Federal criteria or guidelines.
- .4 Sampling frequencies will be in accordance with applicable and current Federal and Provincial regulations.

#### **1.10 UNANTICIPATED SOIL CONTAMINATION**

- .1 Refer to contract General Conditions.
- .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.

#### **Part 2 Products**

##### **2.1 NOT USED**

- .1 Not Used.

#### **Part 3 Execution**

##### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1 General**

**1.1 SUMMARY**

- .1 This Section references to laws, by laws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction, and other legally enforceable requirements applicable to Work and that are; or become, in force during performance of Work.

**1.2 RELATED REQUIREMENTS**

- .1 Perform Work in accordance with the latest National Building Code of Canada (NBC) including amendments up to tender closing date 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.

**1.3 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions and Municipal by-laws.

**1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Except as otherwise specified, Contractor shall apply for, obtain, and pay fees associated with, permits, 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 Contractor to confirm with DCC Representative that surrounding infrastructure is owned and operated by DND:
  - .1 If true, DCC Representative to notify DND PM to contact Property Officer for their comments.
- .2 Contractor is not permitted to work on any infrastructure owned by Municipality, other government departments, or a third-party owner (for example, utility companies).
- .3 Contractor is to get written permission from DCC Representative through DND PM and Base Property Officer if work is required on DND owned utilities that cross an easement.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1               GENERAL**

- .1      Quality control remains the responsibility of the Contractor. DCC Representative provides Quality Assurance.
- .2      Contractor shall provide a contract specific Quality Control Plan to the DCC Representative for review and acceptance prior to first progress payment. The contract specific Quality Control Plan shall include specific and detailed responsibilities of the Contractor's staff to demonstrate how they will ensure that the Work meets the specifications and drawings of the Contract. This would typically be accomplished by hiring and third-party materials testing agency. All costs by a third-party testing agency shall be borne by the Contractor.

**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               INDEPENDENT INSPECTION AGENCIES**

- .1      Independent Inspection/Testing Agencies may be engaged by DCC Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by DCC Representative.
- .2      Provide equipment required for executing inspection and testing by appointed agencies.
- .3      Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4      If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by DCC Representative at no cost to DCC Representative. Pay costs for retesting and reinspection.
- .5      Contractor is responsible for all Quality Control, including submitting inspection testing to demonstrate work is in accordance with Contract Documents. This would typically be accomplished by hiring and third-party materials testing agency. All costs by a third-party testing agency shall be borne by the Contractor.

#### **1.4 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.

#### **1.5 PROCEDURES**

- .1 Notify appropriate agency and DCC Representative 3 business days 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.

#### **1.6 REJECTED WORK**

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

#### **1.7 REPORTS**

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

#### **1.8 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.

#### **1.9 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to DCC Representative.
- .3 Prepare mock-ups for DCC Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, DCC Representative will assist in preparing schedule fixing dates for preparation.



**1.10 MILL TESTS**

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

**1.11 EQUIPMENT AND SYSTEMS**

- .1 Submit adjustment and balancing reports for mechanical, electrical, and building equipment systems.
- .2 Refer to Sections for definitive requirements.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCES**

- .1 Occupational Health and Safety Act (OHSA):
  - .1 Ontario Regulation 213/91 for Construction Projects.

**1.2 INSTALLATION REMOVAL**

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Coordinate with governing authorities and obtain required permits.
- .3 Remove from site all such work after use.

**1.3 FUNCTIONAL REQUIREMENTS**

- .1 Provide all necessary hoists for work.
- .2 Locate hoists where directed by DCC Representative.

**1.4 DESIGN CRITERIA**

- .1 When required by code, scaffolding, and scaffold enclosures shall be designed and certified by a Professional engineer, retained by Contractor, and licensed in the Province of Ontario. The same Professional engineer must approve, in writing, additions, or modifications to scaffolding:
  - .1 Scaffold and enclosure must be built to withstand, and all wind, rain, and snow loads applicable to construction site in accordance with NBC and OBC.
  - .2 Scaffold may be loaded up to 2.40 kPa. No more than 5 (five) working levels shall be loaded at one time.
- .2 Where scaffolding must be supported by existing structures, DCC Representative shall provide on request, information from the Owner on the condition, and capacity of the existing structure in sufficient detail to allow the Contractor to complete scaffolding design.

**1.5 GENERAL REQUIREMENTS FOR SCAFFOLDING**

- .1 Power elevated platforms may be used as part of the access system for the work if suitable to complete the work and provide access for inspection. Use of elevated work platforms shall be subject to remaining within the load lifting limits of such machines, accommodating traffic required for operations (delivery, garbage, recycling trucks, etc.), and providing ready access to both the DCC Representative and designated inspectors such that the work can be inspected while in progress and once complete. Design scaffolds as follows:
  - .1 Platforms shall be prefabricated clip platforms, planks are not permitted.
  - .2 Scaffolds shall have proper stairs; ladders and trap doors are not permitted.
  - .3 Scaffolds shall be built of modular parts whenever possible.
  - .4 Scaffold accessories including braces and jackscrews shall be compatible with the capacity of frames.

- .5 Provide internal horizontal x-bracing at all planking levels.
- .6 Platforms shall be wide enough to circulate and temporarily store materials.
- .7 Platforms shall be designed to support extra loads of removed materials.
- .8 Provide steel guardrails, including toe boards, intermediate rails, and handrails, at perimeter and around openings of all work platforms.
- .9 Scaffold design and erection shall be in accordance with the "Occupational Health And Safety Act" and "Regulations For Construction Projects", and relevant Municipal, Provincial, and Federal regulations.
- .2 Scaffolding shall be tied back to the masonry using push-pull ties. Scaffolding shall be isolated from walls or surfaces with 12 mm thick rubber or neoprene pads. Show all anchor locations and ties on shop drawings. DCC Representative shall review anchor locations prior to installation.
- .3 Scaffold roofs shall be waterproof and meet Design Criteria.

## **1.6 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for review shop drawings of scaffold and weather enclosure system including:
  - .1 Scaffold assembly drawings.
  - .2 Scaffold anchoring.
  - .3 Enclosure fabric with fastening and support system if applicable.
  - .4 Waterproofing details for scaffold roof.
  - .5 Indicate on drawings distance from platforms to wall surface to be worked on.

## **Part 2 Products**

### **2.1 TUBULAR SCAFFOLD**

- .1 Tubular scaffold, scaffold bridge, stair, side brackets, work platforms, guardrails, barricades, and other accessories shall be an engineered type modular tubular scaffold system.
- .2 Complementary 50 mm diameter tube and clamp assemblies may be used where structural reinforcement is required and/or irregular geometry prevents use of modular parts.
- .3 All components shall be hot dip galvanized steel.
- .4 Platforms shall be clip type prefabricated platforms; wood planks are not permitted.

### **2.2 ACCESSORIES**

- .1 Spacers and protection pads: rubber or neoprene spacers: 12 mm thick min.
- .2 Pipe fasteners: 3 mm thick min. galvanized steel fasteners designed for 25 mm and for 50 mm exterior diameter tubing.

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**Part 3            Execution**

**3.1                INSTALLATION**

- .1        The erection of the scaffold cannot commence prior to review of the shop drawings.
- .2        A competent worker shall supervise erection of the scaffold.
- .3        Professional engineer that prepared shop drawings shall inspect the scaffold before it used to ensure that it is erected in accordance with design drawings.
- .4        Scaffolds:
  - .1        Install engineered scaffold, stairs, and aluminum track system in accordance with approved shop drawings and mock-ups.
- .5        Enclosure and Netting:
  - .1        Use plastic wrap ties to fasten netting securely to scaffolding where applicable.

**3.2                REMOVAL**

- .1        Remove temporary scaffolding and enclosures when directed by the DCC Representative.
- .2        Coordinate removal work with the DCC Representative.

**END OF SECTION**

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**Part 1            General**

**1.1            ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.2            INSTALLATION AND REMOVAL**

- .1    Provide temporary utilities as needed in order to execute work expeditiously.
- .2    Remove from site all such work after use.

**1.3            DEWATERING**

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

**1.4            TEMPORARY WASHROOMS AND POTABLE WATER**

- .1    The Contractor must supply and maintain a potable washroom trailer with two washrooms and running water for any building that is affected by a water service disruption for the full duration of the disruption. For buildings that will be given a temporary water service (see Drawings 651, 652, 653), the facilities may only be removed once the temporary water is commissioned and in operation. The facilities must be provided one (1) day in advance. Locations/placement of the facility must be coordinated with the DCC Representative. The Contractor must also supply ninety-six (96) 500 ml bottles of water or a water cooler for each day affected for each building.

**1.5            WATER SUPPLY**

- .1    Existing water supply may be used free of charge, for construction requirements with prior approval of DCC Representative. Make good any damage.
- .2    DCC Representative will determine delivery points and quantitative limits. Written permission is required before any connection is made. All connections to be completed by licensed trade as required by regulatory and approval authorities.
- .3    Provide at no cost to DND, all equipment and temporary lines to bring these services to project site.
- .4    Supply of temporary services by DND is subject to DND requirements and may be discontinued by DND site representative at any time without notice, without acceptance of any liability for damage or delay, caused by such withdrawal of temporary services.
- .5

**1.6            TEMPORARY HEATING AND VENTILATION**

- .1    Provide temporary heating required during construction period, including attendance, maintenance, and fuel.
- .2    All equipment shall be in good working order and approved by a recognized certification agency.
- .3    Prior to the use of any heating equipment the Chief Fire Inspector of the Base shall be notified and the equipment and installation inspected before any use.

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- .4 No temporary heating equipment utilizing an open flame will be allowed.
  - .5 Unless explicitly stated elsewhere in the specifications, the Contractor is responsible for all heating cost, including equipment, fuel, electricity, and maintenance personnel as required for the duration of the project.
  - .6 Construction heaters used inside building must be vented to outside or be flameless (vent free) type. Solid fuel salamanders are not permitted.
  - .7 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.
  - .8 Maintain temperatures of minimum 10 °C in areas where construction is in progress.
  - .9 Ventilating:
    - .1 Prevent accumulations of dust, fumes, mists, vapours, or gases in areas occupied during construction.
    - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
    - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
    - .4 Ventilate storage spaces containing hazardous or volatile materials.
    - .5 Ventilate temporary sanitary facilities.
    - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
  - .10 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
  - .11 On completion of Work for which permanent heating system is used.
  - .12 When authorized by the DCC Representative, Contractor may use existing building equipment for temporary heat source.
  - .13 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.

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

## **1.7 TEMPORARY POWER AND LIGHT**

- .1 Contractor to provide its own power and lighting services as required to construct the Work. No temporary power or lighting will be provided by DND.

## **1.8 TEMPORARY COMMUNICATION FACILITIES**

- .1 Provide and pay for temporary telephone, fax, data hook up, and line(s) necessary for own use and use of DCC Representative.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1               REFERENCE STANDARDS**

- .1 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
  - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 CSA Group (CSA):
  - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-0121-M1978 (R2003), Douglas Fir Plywood.
  - .3 CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.
  - .4 CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.
- .3 U.S. Environmental Protection Agency (EPA)/Office of Water:
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.2               ACTION AND INFORMATIONAL 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 which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

**1.4               SCAFFOLDING**

- .1 Scaffolding in accordance with CAN/CSA-S269.2 and or Section 01 50 01 - Scaffolding and Weather Protection.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs.

**1.5               HOISTING**

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



- .2 Hoists and cranes to be operated by qualified operator.

#### **1.6 SITE STORAGE/LOADING**

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

#### **1.7 CONSTRUCTION PARKING**

- .1 Parking will be permitted on site.
- .2 DCC Representative will determine where Parking will be permitted on site. Maintain and administer these spaces as directed.
- .3 Provide and maintain adequate access to project site.

#### **1.8 OFFICES**

- .1 Provide office heated to 22 °C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid kit in a readily available location.

#### **1.9 EQUIPMENT, TOOL, AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds when required by Contractor 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.
- .3 Storage location to be approved by DCC Representative.

#### **1.10 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances, if required.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Permanent facilities may be used on approval of DCC Representative.

#### **1.11 CONSTRUCTION SIGNAGE**

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

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

## **1.12 PROTECTION AND MAINTENANCE OF TRAFFIC**

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by DCC Representative.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Dust control: adequate to ensure safe operation at all times.
- .11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by DCC Representative.
- .12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .13 Provide snow removal during period of Work for Contractor's Roads.
- .14 Remove, upon completion of work, haul roads designated by DCC Representative.

## **1.13 CLEAN-UP**

- .1 Remove construction debris, waste materials, and packaging material from work-site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1            ACCESS**

- .1    All Work shall be accessed from DND own property only.

**1.2            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 pot holes 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 gravelled 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.

**1.3            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.

#### **1.4 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 it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
  - .3 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.
  - .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
  - .5 For emergency protection when other traffic control devices are not readily available.
  - .6 In situations where complete protection for workers, working equipment, and public traffic is not provided by other traffic control devices.
  - .7 At each end of restricted sections where pilot cars are required.
  - .8 Delays to public traffic due to Contractor's operators: 15 minutes maximum.
- .2 Provide pilot cars. Equip pilot cars with orange flashing lights and signs clearly designating vehicles as pilot cars.
- .3 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.

#### **1.5 OPERATIONAL REQUIREMENTS**

- .1 Maintain existing conditions for traffic throughout period of contract.

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

---

**Part 1            General**

**1.1               REFERENCE STANDARDS**

- .1 Canadian General Standards Board (CGSB):
  - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
  - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 CSA Group (CSA):
  - .1 CSA-O121-M1978 (R2003), Douglas Fir Plywood.

**1.2               INSTALLATION AND REMOVAL**

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

**1.3               HOARDING**

- .1 Erect temporary site enclosures using 38 mm x 89 mm construction grade lumber framing at 600 mm centers and 1,200 mm x 2,400 mm x 13 mm exterior grade fir plywood to CSA O121.
- .2 Apply plywood panels vertically.
- .3 Provide 1 lockable truck entrance gate and at least 1 pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
- .5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.
- .6 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

**1.4               GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, and open edges of floors and roofs.
- .2 Provide as required by governing authorities.

**1.5               WEATHER ENCLOSURES**

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts, and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

## **1.6 DUST TIGHT SCREENS**

- .1 Provide dust control measures to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

## **1.7 ACCESS TO SITE**

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

## **1.8 PUBLIC TRAFFIC FLOW**

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

## **1.9 FIRE ROUTES**

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

## **1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred by Work, to previous or better condition.

## **1.11 PROTECTION OF BUILDING FINISHES**

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with DCC Representative locations and installation schedule at least 10 working days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

## **1.12 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 43 - Environmental Protection.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.



**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to latest date of issue of referenced standards in effect on date of submission of Tender, except where specific date or issue is specifically noted.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, DCC Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by DCC Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

**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 Within 7 Calendar days of written request by DCC Representative, submit following information for materials and equipment proposed for supply:
  - .1 Name and address of manufacturer.
  - .2 Trade name and model catalogue number.
  - .3 Performance and test data.
  - .4 Manufacturers installation instructions.
  - .5 Evidence of arrangement to procure.
- .3 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.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with DCC Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 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 CONTRACTOR'S OPTIONS FOR SELECTING MATERIALS FOR TENDERING**

- .1 Products specified by naming three or more, select any product named. Materials listed as "Acceptable Products" within the contents of this specification identify products known to meet the specified criteria. Other products may exist which meet the requirements specified but have not been listed as "Acceptable Products".

- .2 Where 3 products are listed, the Contractor will choose one of the listed products. If Contractor desires to use alternate products in lieu of the listed acceptable products, the Contractor will follow specified procedures for requesting the use of alternate products - DCL242. The term "Acceptable Product" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name, or any combination thereof.

#### **1.4 SUBSTITUTION**

- .1 No substitutions will be permitted after tender award except under special circumstances described herein.
- .2 A substitution request must include statements of respective costs of items originally specified and the proposed substitution and itemize any differences in quality, performance, and warranty.
- .3 A substitution request may be considered by the DCC Representative if:
  - .1 Materials selected from those specified are not available, discontinued;
  - .2 Delivery date of materials selected from those specified would unduly delay completion of contract; and
  - .3 Alternative material to those specified is equivalent in quality, performance, and warranty to the material specified and will result in a credit to the Contract amount.
- .4 Should substitution be accepted either in part or in whole, assume full responsibility and cost when substitution affects other work on project. Pay for design or drawing changes required as result of substitution.
- .5 Amounts of all credits arising from approval of substitution will be determined by DCC Representative and Contract Price will be reduced accordingly.

#### **1.5 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.

## **1.6 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Products supplied by Owner will coordinated by DCC Representative, unless otherwise noted in Contract Documents.

## **1.7 MANUFACTURERS INSTRUCTIONS**

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

## **1.8 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.

## **1.9 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.

## **1.10 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.

## **1.11 REMEDIAL WORK**

- .1 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.

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

#### **1.12 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.

#### **1.13 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.

#### **1.14 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.

#### **1.15 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.

#### **1.16 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by DCC Representative, with minimum of disturbance to Work, building occupants, pedestrian, and vehicular traffic.
- .2 Protect, relocate, or maintain existing active services. When services are encountered notify DCC Representative, cap off in manner approved by Authority Having Jurisdiction. Stake and record location of capped service.

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

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**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 hours 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 with floor to ceiling hoarding 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:
    - .1 Project Name/Description:
    - .2 Contractor Company Name:
    - .3 Project Superintendent's Name/Phone No.:
    - .4 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 Designated substances and hazardous materials, as detailed in the designated substance/hazardous materials survey;
  - .3 Working at heights;
  - .4 Public safety hazards;
  - .5 Electrical hazards;
  - .6 Mechanical hazards;
  - .7 Excavation and trenching hazards;
  - .8 Power mobile equipment hazards; and
  - .9 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.

- Part 2            Products**
- 2.1               NOT USED.**
- .1       Not Used.
- Part 3            Execution**
- 3.1               NOT USED.**
- .1       Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1               REFERENCE STANDARDS**

- .1           Owner'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.

**1.3               SURVEY REFERENCE POINTS**

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

**1.4               SURVEY REQUIREMENTS**

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

**1.5               EXISTING SERVICES**

- .1           Before commencing work, establish location and extent of service lines in area of Work, all Base and Provincial Locates must be in hand before work may commence.
- .2           Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by DCC Representative.
- .3           Notify DCC Representative 1 week prior to backfill or capping of any utilities below grade.

## **1.6 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 to DCC Representative.

## **1.7 RECORDS**

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

## **1.8 ACTION AND INFORMATIONAL 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.

## **1.9 EXISTING UTILITIES**

- .1 In General: If damage to any existing infrastructure/utility line occurs during excavation or is found to be damaged, including damage to any coating on the line itself, the excavator shall immediately stop work, leave the utility line exposed, barricade the area, and contact the appropriate utility provider immediately and notify DCC Representative. When a utility line strike occurs after working hours in addition, notify the Central Heating Plant (613-541-5010 ext. 4582).
- .2 Damaged Electrical Line: If there are any flames or sparks originating from an exposed electric distribution line or other works, the excavator shall barricade the area off and keep the public and workers away. Call 911 and the local electric distribution utility immediately.
- .3 Damaged Gas Line: If ANY gas line strike occurs, be it by mechanical equipment or by manual methods, the following actions must be taken immediately. If required, emergency responders will coordinate the evacuation of affected buildings:
  - .1 Stop Work and shut off all tools, machinery, or equipment.
  - .2 Clear everyone from the area.
  - .3 Call 911.
  - .4 Contact the appropriate utility provider immediately.
  - .5 **DO NOT** attempt to control or stop the gas from escaping.

**1.10 UTILITY PROVIDER POINTS OF CONTACT**

- .1 Enbridge Gas: 1-866-763-5427.
- .2 Utilities Kingston: 613-546-1181 ext. 2151.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1            ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submittals: 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 Owner or 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 Owner or separate Contractor.
  - .7          Written permission of affected separate Contractor (if applicable).
  - .8          Date and time work will be executed.

**1.2            MATERIALS**

- .1      Required for original installation.

**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.

**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 Restore work with new products in accordance with requirements of Contract Documents.
- .8 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .9 Provide firestopping to maintain the 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.
- .10 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection or as indicated in contract documents. Refinish assemblies by refinishing entire unit.
- .11 Conceal pipes, ducts, and wiring in floor, wall, and ceiling construction of finished areas except where indicated otherwise.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 Conduct cleaning and disposal operations in accordance with all Federal, Provincial, or Municipal regulatory requirements and guidelines for environmental protection.
- .2 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation system is not permitted for this purpose.
- .3 This section does not apply to cleaning associated with hazardous material removal and disposal operations. Cleaning of these areas is covered in other sections. Once certified as safe by DCC Representative cleaning methods specified herein are applicable.

**1.2 PROJECT CLEANLINESS**

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

**1.3 FINAL CLEANING**

- .1 When Work is Substantially Completed remove surplus products, tools, construction machinery, and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery, and equipment.
- .4 Do not burn waste materials on site.
- .5 Make arrangements with and obtain permits from Authorities Having Jurisdiction for disposal of waste and debris.
- .6 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 if damaged by the Work.

- .7 Remove stains, spots, marks, and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors, if caused by the Work.
- .8 Clean lighting reflectors, lenses, and other lighting surfaces.
- .9 Vacuum clean and dust building interiors, behind grilles, louvres, and screens.
- .10 Wax, seal, shampoo, or prepare floor finishes, as recommended by manufacturer.
- .11 Inspect finishes, fitments, and equipment and ensure specified workmanship and operation.
- .12 Broom clean and wash exterior walks, steps, and surfaces; rake clean other surfaces of grounds.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .15 Sweep and wash clean paved areas.
- .16 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .17 Clean roofs, downspouts, and drainage systems.
- .18 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .19 Remove snow and ice from access to building.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Complete in accordance with Section 01 35 43 - Environmental Protection.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                DEFINITIONS**

- .1        Redline Drawings are those prepared by the Contractor as it constructs the project and upon which it documents the actual locations of the building components and site components and changes to the original contract.
- .2        Record Drawings are prepared by the Consultant or Designer of Work based on information taken from the Contractors Redline Drawings, are not included in the scope of work unless stated in the contract documents.

**1.2                GENERAL**

- .1        The following shall be submitted in the close out package for approval in folders described in this divisional Section:
  - .1        Scanned Redline Drawings.
  - .2        Field Survey Data.
  - .3        O&M Manual.
  - .4        Approved Shop Drawings.
  - .5        Warranty Information and if available.
  - .6        Reports.
  - .7        Photos.
  - .8        Spare parts, special tools, and maintenance materials, as indicated in contract documents.

**1.3                FORMAT**

- .1        The main folder structure for the closeout package submittal is to be organized as follows:
  - .1        910 - Redline Drawings.
  - .2        920 - Record Drawings:
    - .1        921 - Field Survey Data.
  - .3        930 - O&M Manual.
  - .4        940 - Approved Shop Drawings.
  - .5        950 - Warranty Information.
  - .6        960 - Reports.
  - .7        970 - Photos.
  - .8        980 - Spare parts, special tools, and maintenance materials, as indicated in contract documents.
- .2        Only electronic format is to be submitted.
- .3        Allow 10 working days for closeout package to be reviewed by DCC Representative and DND Project Manager.

- .4 All Cover Sheets: Project Title, Building Number, Drawing Number, Project Number, DCC KN Number, and identify subject matter of contents.
- .5 Arrange content by Specification Section numbers and sequence of Table of Contents.
- .6 Provide separate sections for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Submission is to be provided using DCC's electronic file transfer platform.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Completion of the Work, submit to the DCC Representative, an electronic copy of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials, and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source, and quality of products supplied.

#### **1.5 REDLINE DRAWINGS**

- .1 As-Builts, Field Record Drawings, and Redlines are interchangeable terms meaning Redlines.
- .2 Contractor is to provide a printed copy of the drawing set for the intended purpose of creating redline drawings with the words "Redlines" in red written on each page.
- .3 Contractor to record changes in red as made and authorized on one set of prints referred to as "Redline Drawings" and at substantial completion of project and prior to final inspection scan and submit drawings to DCC Representative. DCC Representative will review and initial to concur with the content of the final markups.
- .4 Provide copies of complete reline drawings and survey CAD file for each site upon commissioning of the new system (i.e. do not wait until the end of the project to submit all data at once) .
- .5 All Site Instruction Numbers and Change Order Numbers are to be annotated on the Redline Drawing set.
- .6 Contractor to maintain information on project site drawings and record accurately, deviations of newly installed or existing plant works from Contract documents during construction.
- .7 Contractor will submit for record drawings purposes the original set of redline drawings from construction site used for keeping track of contract design and site condition changes.
- .8 The Contractor shall ensure but not limit to the recording of the following information on the original Redline drawings:
  - .1 Depths of various elements of foundation in relation to first floor level or finished grade elevation.
  - .2 Horizontal and vertical locations of existing and new underground utilities and appurtenances as well as the alignment, bend, and curves of buried utilities such as communication, power, water, sewer, storm and natural gas ducts, pipes, and

lines shall be surveyed and be geographically referenced to the coordinate system of the drawing or accurately dimensioned to surfaces features shown in the drawing.

- .3 Locations of internal utilities and appurtenance concealed in construction, referenced to visible and accessible features of structure.
- .4 Field changes of dimension and detail, such as but not limited to:
  - .1 For Buildings: Door locations, duct sizes, piping valve, equipment layout, and cable tray alignment.
  - .2 For Civil/Utilities: road widths, curve radii, alignment, curb radii, sidewalk extents, and conduit/pipe sizes.
- .5 Changes made by Change Order.
- .6 Utilities shall be identified as abandoned, existing or new.

## **1.6 FIELD SURVEYING & DATA FILE**

- .1 Contractor to notify the DCC Representative with 2 working days' notice if any buried utility or infrastructure is being exposed to allow for survey by a DND surveyor.
- .2 DND surveyor is allowed access to site to survey.
- .3 Should DND surveyor require special site safety training, the Contractor will notify DCC Representative prior to allow time to be trained.
- .4 Should the Contractor have their own Surveyor, and data is collected, it will be submitted with the closeout package.
- .5 Field survey data file for service structures, manholes, catch basins, vaults, valves, hydrants, etc. shall be submitted in Excel sheet file format. DCC Representative will get an Excel template to be populated from DND. File will contain preset fields to be populated.
- .6 Field survey performed for Municipal/Civil Works forming Part of Project shall:
  - .1 Be collected in ASCii format and shape file.
  - .2 ASCii file (Test File) shall contain point ID, Northing, Easting, Elevation, and Descriptor.
  - .3 Shape files (.shp, ESR1 format) shall include point ID, Northing, Easting, Elevation, and Descriptor.

## **1.7 O&M MANUALS**

- .1 Electronic files are to be arranged and indexes into the same numerical order as the contract Specification Section. A maximum of 300 pages per file.
- .2 The use of Bookmarks within PDF is an acceptable practice.
- .3 Warranties are to remain in the Manual under each Section.
- .4 Table of Contents for Each Volume:
  - .1 Provide Project Title.
  - .2 Building Number.
  - .3 Drawing Number.

- .4 DND Project Number.
- .5 DCC KN Number.
- .6 Date of submission.
- .7 Names, addresses, and telephone numbers of Contractor with name of responsible parties.
- .8 List of products and systems, indexed to content of volume.
- .5 For each product or system:
  - .1 List names, addresses, and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- .6 Product Data: Mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .7 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .8 Text: as required to supplement product data:
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .9 Training: Refer to Section 01 79 00 - Demonstration and Training.

## **1.8 APPROVED SHOP DRAWINGS**

- .1 Only copies of approved shop drawings and product data are to be submitted. Rejected and non-approved shop drawings and product data are not to be included.
- .2 Approved shop drawings for temporary works required to facilitate construction and that will be removed during or at the completion of construction are not required to be submitted in the closeout package.

## **1.9 WARRANTY**

- .1 A Cover Sheet and Table of Contents containing all project related warranties with each item's expiry date is to be created.
- .2 All project related warranties are to be copied into this folder listed by specification Section.
- .3 Submit a summary of warranty information to DCC Representative for any warranties:
  - .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 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.
- .4 Respond in timely manner to oral or written notification of required construction warranty in the closeout package.

#### **1.10 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 as specified in Section 01 45 00 - Quality Control and Section 01 91 13 - General Commissioning (CX) Requirements.

## **1.11 MATERIALS AND FINISHES**

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations:
  - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications Sections.

## **1.12 MAINTENANCE MATERIALS**

- .1 Spare Parts:
  - .1 Provide spare parts, in quantities specified in individual specification sections to DCC Representative.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed by DCC Representative; place and store.
  - .4 Receive and catalogue items:
    - .1 Submit inventory listing to DCC Representative.
    - .2 Include approved listings in Maintenance Manual.
- .2 Extra Stock Materials:
  - .1 Provide maintenance and extra materials, in quantities specified in individual specification Sections to DCC Representative.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed by DCC Representative; place and store.
  - .4 Receive and catalogue items:
    - .1 Submit inventory listing to DCC Representative.
    - .2 Include approved listings in Maintenance Manual.
- .3 Special Tools:
  - .1 Provide special tools, in quantities specified in individual specification Section to DCC Representative.
  - .2 Provide items with tags identifying their associated function and equipment.
  - .3 Deliver to location as directed by DCC Representative; place and store.
  - .4 Receive and catalogue items:
    - .1 Submit inventory listing to DCC Representative.
    - .2 Include approved listings in Maintenance Manual.



**1.13 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.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1 General**

**1.1 ADMINISTRATIVE REQUIREMENTS**

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel as scheduled with the DCC Representative.
- .2 Preparation:
  - .1 Verify conditions for demonstration and instructions comply with requirements.
  - .2 Verify designated personnel are present.
  - .3 Ensure equipment has been inspected and put into operation.
  - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .3 Demonstration and Instructions:
  - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.
  - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
  - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for DCC Representative's approval.
- .3 Provide electronic copy of completed Operation and Maintenance manuals for use in demonstrations and instructions.

**1.3 QUALITY ASSURANCE**

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
  - .1 Instruct personnel as designated by the DCC Representative.
  - .2 Provide written report that demonstration and instructions have been completed.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                SUMMARY**

- .1        Section Includes:
  - .1            This Section specifies role and responsibilities of Commissioning Training.

**1.2                TRAINEES**

- .1        Trainees: personnel selected for operating and maintaining this facility. Includes Property, 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 for purposes of familiarization with systems.

**1.3                INSTRUCTORS**

- .1        Contractor and certified factory-trained manufacturer's personnel to provide instruction on the following:
  - .1            Start-up, operation, shut-down of equipment, components, and systems.
  - .2            Control features, reasons for, results of, implications on associated systems of, and adjustment of set points of control and safety devices.
  - .3            Instructions on servicing, maintenance, and adjustment of systems, equipment, and components.
- .2        Contractor and equipment to provide instruction on:
  - .1            Start-up, operation, maintenance, and shut-down of equipment they have certified installation, started up, and carried out PV tests.

**1.4                TRAINING OBJECTIVES**

- .1        Training to be detailed and sufficient in 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, and 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        Instructors to be responsible for content and quality.
- .2        Training to consist of demonstration of use and maintenance of equipment and systems.
- .3        DCC Representative and DND Project Manager will review training manuals.

- .4 Training materials to be in a format that permits future training procedures to same degree of detail.

## **1.6 SCHEDULING**

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.

## **1.7 RESPONSIBILITIES**

- .1 Contractor to be responsible for:
  - .1 Implementation of training activities,
  - .2 Coordination among instructors,
  - .3 Quality of training, training materials, and
  - .4 Handouts including all necessary information (i.e. flow charts, schematics, function/operations/interconnection information).

## **1.8 TRAINING CONTENT**

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
  - .1 Equipment and system start-up, operation, monitoring, servicing, maintenance, and shut-down procedures.
  - .2 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings, and emergency procedures.
  - .3 Maintenance and servicing, including spare parts recommended to be stored as site.
  - .4 Trouble-shooting diagnosis.
  - .5 Inter-Action among systems during integrated operation.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 SUMMARY**

- .1 Section Includes:
  - .1 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 Section 01 45 00 - Quality Control.
  - .2 Section 01 35 43 - Environmental Protection.
  - .3 Section 01 41 00 - Regulatory Requirements.
  - .4 Division 22 - Plumbing.
  - .5 Division 23 - Heating, Ventilating and Air Conditioning.
  - .6 Division 26 - Electrical.
- .3 Acronyms:
  - .1 AFD - Alternative Forms of Delivery, service provider.
  - .2 BMM - Building Management Manual.
  - .3 CPS - Commissioning Plan Schedule.
  - .4 DCC - Defence Construction Canada.
  - .5 EMCS - Energy Monitoring and Control Systems.
  - .6 ESR - Equipment Start-Up and Acceptance Report.
  - .7 O&M - Operation and Maintenance.
  - .8 RPoPS - Real Property Operations (Base Engineering and Shops).
  - .9 SFPTF - System Functional Performance Test Form.
  - .10 SVF - System Verification Form.
  - .11 TAB - Testing, Adjusting, and Balancing.

### **1.2 GENERAL**

- .1 Contractor shall organize all Static Testing and Documentation, Manufacture and Trade Start up Reports, Installation Check Sheets completion. Ensuring Contractor's Verification and integrated testing has been completed before requesting the final commissioning with DCC.
- .2 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 DND at the request of the Contractor and the schedule.
- .3 Objectives:
  - .1 To bring 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.
- .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.
- .4 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 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.
  - .4 AS-BUILT 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.

### **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 Representative.
- .3 Inform DCC Representative 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 Section 01 33 00 - Submittal Procedures:
  - .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 DCC to review and approve commissioning documentation.
- .2 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, Subcontractors, 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 SVF.
    - .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 WSO 5-16 and Section 01 35 43 - Environmental Protection.
  - .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, DCC shall reject equipment:
    - .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 Manufacturer's long term storage process and identify to DCC.
- .3 After completion of the dynamic commissioning, operate and maintain systems until issuance substantial completion certificate. 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 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, AND DEFECTS**

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

### **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 Representative.
- .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, Manufacturer's Start-up Reports, Contractor's installation Check Sheets, and 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.
- .5 Training:
  - .1 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.
  - .2 To be video taped for all major Mechanical, Electrical, and Communication System as per design requirements.
  - .3 Major Equipment Training to be on site when systems have been fully commissioned and operational.
  - .4 BAS Controls systems will be onsite with the building front end after commissioning of sequence of operation and graphic have been completed.
  - .5 If the contract documents require remote BAS operation from another building training will need to be completed at that site to ensure communication connection is operational.

**Part 2            Products**

**2.1               COMMISSIONING SAMPLE FORMS**

- .1       DCC can supply electronic copies of Commissioning forms as per this Section 01 91 13 - General Commissioning (Cx) Requirements at the request of the Contractor

**Part 3            Execution**

**3.1               NOT USED**

- .1       Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                SUMMARY**

- .1    Section includes:
  - .1        Demolition and disposal of select site items;
  - .2        Removal and reinstallation of select site items; and
  - .3        Repair and restoration work after completion of work of this Section.

**1.2                RELATED REQUIREMENTS**

- .1    Section 02 41 13.13 – Paving Removal.
- .2    Section 31 23 33.01 – Excavating, Trenching and Backfilling.

**1.3                DEFINITIONS**

- .1    Construction equipment: Machinery or equipment required to prepare, fabricate, move, erect, or otherwise perform the Work. Does not include machinery or equipment incorporated into the Work.
- .2    Hazardous material: Controlled product and a chemical, biological, or physical agent that, by reason of a property that the agent possesses, is hazardous to the safety or health of a person exposed to it. Synonymous with the definition of hazardous substance in the Canada Labour Code.
- .3    Selective site demolition: The act of removing specific identified items from the project site, typically performed before construction work begins on site.
- .4    Waste management coordinator: In accordance with Section 01 74 00 – Cleaning & Waste Management.

**1.4                REFERENCE STANDARDS**

- .1    Canadian Council of Ministers of the Environment (CCME):
  - .1        PN 1326-2003, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .2    Employment and Social Development Canada (ESDC):
  - .1        R.S.C., 1985, c. L-2, Canada Labour Code.
- .3    Health Canada (HC):
  - .1        R.S.C. 1985, c H-3, Hazardous Products Act.
- .4    ULC Standards (ULC):
  - .1        CAN/ULC-S664:2017, Standard for Containment Sumps, Sump Fittings, and Accessories for Flammable and Combustible Liquids.
  - .2        CAN/ULC-S679:2017, Standard for Metallic and Nonmetallic Underground Piping for Flammable and Combustible Liquids.

- .3 ANSI/CAN/UL/ULC 2583:2021, Standard for Safety, Fuel Tank Accessories for Flammable and Combustible Liquids.

## **1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-demolition meetings: Conduct a site meeting in accordance with Section 01 11 00 - Summary of Work/General Instructions and attended by the DCC Representative and appropriate Subcontractors to:
  - .1 Verify project requirements, including existing construction conditions affected by work of this Section, scope of selective site demolition work, demolition sequencing, and protection of in-place conditions.
  - .2 Review scheduling of utility disruptions that may affect building occupants.
  - .3 Review the Construction and Demolition Waste Management Plan (CDWMP) specified in Section 01 74 00 – Cleaning & Waste Management.
  - .4 Review waste reporting requirements.
- .2 Scheduling:
  - .1 Maintain project schedule without compromising specified material diversion rates.
  - .2 Notify the DCC Representative of unforeseen delays in writing.

## **1.6 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Schedule of selective site demolition activities: In accordance with Section 01 32 16.19 – Construction Progress Schedule:
  - .1 Indicate, at minimum:
    - .1 Detailed sequence of selective site demolition and removal work.
    - .2 Utility service interruptions.
- .3 Shop Drawings:
  - .1 Signed and sealed by a qualified professional in accordance with Section 01 45 00 – Quality Control.
  - .2 Selective site demolition drawings, diagrams, details, or procedure showing sequence of selective site demolition:
    - .1 Locations of temporary partitions and means of egress;
    - .2 Coordination of shutoff, capping, and continuation of utility services; and
    - .3 Proposed dust control and noise-control measures, including locations, and durations.
- .4 Site quality control submittals:
  - .1 Pre-demolition photographs or video recordings as specified in EXAMINATION in this Section.

- .5 Submit copies of the following, when required by the Authority Having Jurisdiction (AHJ):

- .1 Reviewed Shop Drawings; and
- .2 Reviewed demolition procedures.

## **1.7 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operation and maintenance data:
  - .1 Include, in the operation and maintenance manual, manufacturer’s maintenance instructions and recommended cleaning materials and methods:
    - .1 Submit maintenance and operating instructions for repair materials used in the Work.

## **1.8 QUALITY ASSURANCE**

- .1 Licensed professional qualifications: In accordance with Section 01 45 00 – Quality Control.

## **1.9 SITE CONDITIONS**

- .1 Stop work immediately and take preventative measures if hazardous materials are encountered, aside from the ones listed above:
  - .1 Notify the DCC Representative immediately.
  - .2 Proceed with work after receipt of written instructions from the DCC Representative.

## **Part 2 Products**

### **2.1 MATERIAL OWNERSHIP**

- .1 Coordinate material ownership with the DCC Representative.
  - .1 The Owner will retain ownership of:
    - .1 Items to remain;
    - .2 Items to be reused;
    - .3 Items to be reinstalled;
    - .4 Historic items, relics, and similar objects; and
    - .5 Other items of interest or value to the owner that may be encountered during demolition.
  - .2 Take possession of demolished materials and remove from site.

### **2.2 REPAIR MATERIALS**

- .1 Use repair materials identical to existing materials:
  - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces as closely as possible.



- .2 Use materials whose installed performance equals or surpasses that of existing materials.

### **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 and coordinate with indicated requirements to determine extent of demolition required.
    - .2 Photograph or video record existing conditions of adjoining construction and site improvements before starting selective site demolition. Include finish surfaces that may be misconstrued as damage caused by work of this Section.
    - .3 Review record documents of existing site available from the DCC Representative.
      - .1 The DCC Representative does not guarantee record documents are accurate, complete, or appropriate.
    - .4 When unanticipated structural, mechanical, electrical, or other issues are encountered that interfere with demolition or removal, investigate and measure the nature and extent of the interference:
      - .1 Promptly submit a written report to the DCC Representative.
    - .5 Verify Hazardous Materials have been abated before proceeding with work of this section.

#### **3.2 PREPARATION**

- .1 Protection of in-place conditions:
  - .1 Provide temporary controls, in accordance with Section 01 35 43 - Environmental Protection, to protect adjacent watercourses, groundwater, and wildlife, and to mitigate excess air-and noise pollution:
    - .1 Prevent debris from blocking surface drainage systems, elevators, and mechanical-or electrical systems to remain in operation.
    - .2 Provide dust-tight screens or partitions in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.
  - .2 Use methods, certified by a qualified licensed professional to prevent movement, settlement, or damage to adjacent properties buildings, structures, utilities, and landscaping to remain in place:
    - .1 Provide temporary bracing and shoring as required.
  - .3 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, grades, and properties:
    - .1 Provide bracing, shoring, and underpinning as required.

- .4 Support affected site items and, if safety of site item being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop working, and immediately notify the DCC Representative.
- .2 Existing services:
  - .1 Comply with Section 01 11 00 – Summary of Work and:
    - .1 Disconnect and reroute electrical and service lines within the site.
      - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of selective site demolition.
    - .2 Disconnect and cap designated mechanical services:
      - .1 Natural gas supply lines: Remove in accordance with gas company requirements.
      - .2 Sewer and water lines: Remove in accordance with AHJ requirements.
  - .2 Disruption of active or energized utilities designated to remain undisturbed is not permitted.

### **3.3 CONSTRUCTION EQUIPMENT EMISSION MANAGEMENT**

- .1 Minimize construction equipment emissions while performing work of this Section.
- .2 Shut down construction equipment when not in use, except where extreme temperatures prohibit shutting Construction Equipment.

### **3.4 DEMOLITION**

- .1 Demolish items as indicated on the Drawings.
  - .1 Demolish pavements, curbs, and gutters:
    - .1 Square up adjacent surfaces to remain in place by saw cutting or other method producing a smooth, straight edge.
    - .2 Protect adjacent joints and load transfer devices.
    - .3 Protect underlying and adjacent granular materials.
  - .2 Excavate at least 300 mm below pipe inverts when removing pipes under existing or future pavement area.

### **3.5 REMOVAL AND REINSTALLATION**

- .1 Remove items indicated on the Drawings:
  - .1 Asphalt pavement: Prevent contamination with base-course aggregates, when removing asphalt pavement for subsequent incorporation into hot-mix asphalt paving, in accordance with Section 02 41 13.13 – Paving Removal.
- .2 Examine removed items. Confirm DCC Representative's acceptance for reinstallation if removed items appear in poor condition.
- .3 Temporarily store, protect, and prepare removed items for reuse:
  - .1 Stockpiling:

- .1 Label stockpiles; indicate material types and quantities.
- .2 Stockpile materials in convenient location for use in new construction to eliminate double handling wherever possible.
- .3 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.
- .4 Stockpile topsoil for final grading and landscaping:
  - .1 Provide erosion control of stockpile and seeding if not immediately used.
- .4 Reinstall removed items as indicated on the Drawings.

### **3.6 RESTORATION**

- .1 Backfill: Backfill areas, as indicated, in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .2 Restore areas and existing work outside areas of demolition to conditions that existed before beginning of Work.
- .3 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses, or ground water.
- .4 Repair damage caused by work of this Section to satisfaction of the DCC Representative.

### **3.7 CLEANING**

- .1 Clean in accordance with Section 01 74 00 – Cleaning & Waste Management, and:
  - .1 Remove debris, trim surfaces, and leave work site clean, upon completion of work.
  - .2 Use cleaning materials and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses, or ground water.
- .2 Waste management:
  - .1 Manage waste in accordance with Section 01 74 00 – Cleaning & Waste Management, and:
    - .1 Remove stockpiled material designated for removal when it interferes with the Work.
    - .2 Remove stockpiles of like materials designated for removal and alternate disposal option once material collection is complete.
    - .3 Disposal of waste of volatile materials, including mineral spirits, oil, petroleum-based lubricants, or toxic cleaning solutions into watercourses, or storm-or sanitary sewers, is not permitted.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Methods for removal of existing asphalt pavement.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Asphalt can be removed utilizing cold milling, planning, grinding, or excavation equipment.
- .2 For partial depth asphalt removal; use cold milling, planning, or grinding equipment with automatic grade controls, and capable of removing part of pavement surface to depths or grades indicated on drawings.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Prior to beginning removal operation, inspect and verify with DCC Representative areas, depths, and lines of asphalt pavement to be removed. Saw cut along limit of asphalt to be removed.

**3.2 PROTECTION**

- .1 Protect existing pavement not designated for removal, light units, and structures from damage. In event of damage, immediately replace or make repairs to approval of DCC Representative at no additional cost.

**3.3 REMOVAL**

- .1 Remove existing asphalt pavement to lines, grades, and depths as indicated, and as required in order to perform the underground servicing where applicable. Refer to drawings for full depth or partial depth existing asphalt removal areas.
- .2 Use equipment and methods of removal and hauling which do not damage or disturb underlying or adjacent pavement where designated to remain as per the drawings.
- .3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel, or other materials.
- .4 Provide for suppression of dust generated by removal process.
- .5 Recycled Asphalt Pavement (RAP) created during removals are acceptable for disposal at a nearby DND yard within CFB Kingston, approximately 2.2 km from worksite provided the asphalt is milled and not blended w/ soil. Free of any deleterious materials. Disposal at a nearby on-site following milling, or hauling offsite will be subject to the Contractor's choice.
- .6 Refer to Section 01 35 43 – Environmental Procedures.

**3.4 SWEEPING**

- .1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

**END OF SECTION**

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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1       Section 03 30 00.09 - Cast-In-Place Concrete - Short Form.

**1.2               REFERENCE STANDARDS**

- .1       ASTM International (ASTM):
  - .1       ASTM A108-18, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
  - .2       ASTM A1064/A1064M-18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .2       CSA Group (CSA):
  - .1       CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2       CSA A283-19, Qualification code for Concrete Testing Laboratories.
  - .3       CSA A23.3-19, Design of Concrete Structures.
  - .4       CSA G30.18-21, Carbon Steel Bars for Concrete Reinforcement.
  - .5       CSA G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3       Reinforcing Steel Institute of Canada (RSIC):
  - .1       RSIC-2020, Reinforcing Steel Manual of Standard Practice.

**1.3               ADMINISTRATIVE REQUIREMENTS**

- .1       Preinstallation Meetings: Hold pre-concrete pouring meeting one week before pouring concrete:
  - .1       Ensure Contractor, affected Subcontractors, and DCC Representative attend:
    - .1       Verify project requirements.
    - .2       Review reinforcing testing report.
    - .3       Discuss coordination with other Subcontractors.

**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 proprietary materials used in concrete reinforcement. Include product characteristics, performance criteria, physical sizes, finishes, and limitations.

- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada:
    - .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
    - .2 Indicate placing of reinforcement, and:
      - .1 Bar bending details.
      - .2 Lists.
      - .3 Quantities of reinforcement.
      - .4 Sizes, spacing, locations of reinforcement, and mechanical splices if approved by DCC Representative, with identifying code marks to permit correct placement without reference to structural drawings.
      - .5 Indicate sizes, spacing and locations of chairs, spacers, and hangers.
    - .3 Detail lap lengths and bar development lengths to CAN/CSA A23.3:
      - .1 Provide Type B tension lap splices unless otherwise indicated on Drawings.
    - .4 Indicate position and size of openings in pads and foundations. Coordinate with trades requiring openings.
    - .5 Indicate the concrete cover dimension to the reinforcement.
- .4 Quality Assurance Submittals:
  - .1 Mill Test Report: When requested, submit to DCC Representative certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work:
    - .1 Testing Laboratory: Certified to CSA A283.
  - .2 Upon request submit in writing to DCC Representative proposed source of reinforcement material.

## 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Replace defective or damaged materials with new.

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**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 Cold-drawn annealed steel wire ties: To ASTM A1064/A1064M.
- .4 Deformed steel wire for concrete reinforcement: To ASTM A1064/A1064M.
- .5 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.
- .6 Tie wire: 1.5 mm diameter annealed wire.
- .7 Mechanical splices: subject to approval of DCC Representative.
- .8 Plain Round Bars: To CSA G40.20/G40.21.

**2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and 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 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

**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 site bending authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

**3.2 PLACING REINFORCEMENT**

- .1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.
- .2 Place reinforcing steel as indicated on placing drawings in accordance with CSA A23.1/A23.2.
- .3 Use plain round bars as slip dowels in concrete:
  - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
  - .2 Apply thick even film of mineral lubricating grease when paint is dry.
- .4 Before placing concrete, obtain DCC Representative's approval of reinforcing material and placement.
- .5 Maintain cover to reinforcement during concrete pour.



### **3.3 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .3 Waste Management: separate waste materials for recycling.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 03 20 00 - Concrete Reinforcing.
- .2      Section 05 05 19 - Post-Installed Anchors.
- .3      Section 09 96 35 - Chemical-Resistant Coatings.

**1.2            REFERENCE STANDARDS**

- .1      ASTM International (ASTM):
  - .1      ASTM C171-20, Standard Specification for Sheet Materials for Curing Concrete.
  - .2      ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .3      ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .4      ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
  - .5      ASTM C578-23, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
  - .6      ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.
  - .7      ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .8      ASTM C1315-19, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
  - .9      ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.
  - .10     ASTM D695-21, Standard Test Method for Compressive Properties of Rigid Plastics.
  - .11     ASTM D1751- 04 (2013) e1 , Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
- .2      CSA Group (CSA):
  - .1      CSA A23.1/A23.2- 19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2      CSA A23.3-19, Design of Concrete Structures.
  - .3      CSA A3000-23, Cementitious Materials Compendium.
  - .4      CSA G30.18-21, Billet-Steel Bars for Concrete Reinforcement.
  - .5      CAN/CSA O86- 19, Engineering Design in Wood.
  - .6      CSA O121- 17, Douglas Fir Plywood CSA O141- 05 (R2014), Softwood Lumber.
  - .7      CSA S269.1- 16, Falsework and Formwork.

- .3 Underwriters' Laboratories of Canada (ULC):
  - .1 CAN/ULC-S701.1- 22, Standard for Thermal Insulation, Polystyrene, Boards.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Preinstallation Meetings: Hold preinstallation meeting one week before beginning concrete works:
  - .1 Ensure DCC Representative, site supervisor, and affected Subcontractors attend.
  - .2 Verify project requirements.

### **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 proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit WHMIS Safety Data Sheet (SDS) in accordance with local requirements:
    - .1 Submit 2 copies of WHMIS SDS.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada:
    - .1 Submit placing drawings prepared in accordance with Section 03 20 00 - Concrete Reinforcing.
    - .2 Submit drawings showing formwork and falsework design to: CSA A23.1/A23.2 and CSA S269.1:
      - .1 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
      - .2 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.
    - .3 Indicate sequence of erection and removal of formwork.
- .4 Provide testing results reports for review by DCC Representative and do not proceed without written approval when deviations from mix design or parameters found.
- .5 Concrete hauling time: provide for review by DCC Representative deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.
- .6 Quality Assurance Submittals:
  - .1 Upon request submit in writing to DCC Representative proposed source of reinforcement material. Material may be subject to material testing to confirm grade of steel.

- .2 At least four (4) weeks before beginning Work, inform DCC Representative of source of fly ash:
  - .1 Changing source of fly ash without written approval of DCC Representative is prohibited.

## **1.5 QUALITY ASSURANCE**

- .1 Provide to DCC Representative, four (4) weeks minimum before starting concrete work, a valid and recognized certificate from plant delivering concrete.
- .2 Quality Control Plan: provide written report to DCC Representative verifying compliance concrete in place meets performance requirements.
- .3 Submit proposed quality control procedures a minimum four weeks before starting concrete work, for review by DCC Representative on the following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
  - .5 Finishes.
  - .6 Formwork removal.
- .4 Site Quality Control Submittals:
  - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit testing results and reports for review by DCC Representative and do not proceed without written approval when deviations from mix design or parameters are found.
  - .3 Concrete pours: Submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature, and test samples taken as described in SITE QUALITY CONTROL in Part 3 of this Section.
  - .4 Concrete hauling time: Submit deviations exceeding the maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching for review by DCC Representative.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

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

- .3 Deliver, store, and handle formwork and other materials in accordance with Section 01 61 00 - Common Product Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .2 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .3 Store and protect formwork from damages.
  - .4 Replace defective or damaged materials with new.

## **1.7 AMBIENT CONDITIONS**

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

## **Part 2 Products**

### **2.1 DESIGN CRITERIA**

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

### **2.2 PERFORMANCE CRITERIA**

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

### **2.3 MATERIALS**

- .1 Portland Cement: GU.
- .2 Water: to CSA A23.1/A23.2.
- .3 Admixtures:
  - .1 Air entraining admixture: To ASTM C260/C260M.

- .2 Chemical admixture: to ASTM C1017 and ASTM C494. DCC Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .4 Aggregates: To CSA A23.1/CSA A23.2.
- .5 Reinforcing bars:
  - .1 In accordance with Section 03 20 00 - Concrete Reinforcing.
- .6 Shrinkage Compensating Grout: Premixed compound consisting of non-metallic aggregate, Portland cement, and water reducing and plasticizing agents to CSA A23.1/CSA A23.2.
- .7 Non-Premixed Dry Pack Grout: Composition of non-metallic aggregate and Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .8 Premoulded joint filler:
  - .1 Bituminous impregnated fibreboard: to ASTM D1751 .
- .9 Chemical hardener:
  - .1 Non-metallic, low VOC, premixed, dry shake surface hardener, cement colour.
  - .2 Suitable for industrial and chemical processing facilities.
  - .3 Surface hardness: minimum 8 Mohs.
  - .4 Density to ASTM C128: minimum 3.9 specific gravity.
  - .5 Compressive strength to ASTM C109:
    - .1 24 hours: > 30 MPa.
    - .2 7 days: > 56 MPa.
    - .3 28 days: > 70 MPa.
  - .6 Does not prevent adhesion with subsequently apply coatings, treatments, or other finishes.
- .10 Curing Compound: To ASTM C309 Type 1, clear or translucent without dye, Class B:
  - .1 Waterborne, wax-free, penetrating, non-film forming, dries clear, and does not prevent adhesion with subsequently applied coatings, treatments, or other finishes.
- .11 Joint sealant:
  - .1 Polyurethane sealant, shall remain permanently elastic.
  - .2 Self-Leveling.
  - .3 Type S to ASTM C920.
  - .4 Tensile Strength to ASTM D-412: > 0.6 MPa.
  - .5 Elongation at Break: > 300%.
  - .6 Elastic Recovery: > 90%.
  - .7 Movement Capability:  $\pm 25\%$ .
  - .8 Hardness (Shore A) to ASTM D2240:  $40 \pm 5$ .

- .9 Non-Flammable.
- .12 Concrete floor sealer/topping:
  - .1 Backflow Prevention and Metering Room:
    - .1 Water-based, clear, acrylic protective surface sealing treatment.
    - .2 Meets the moisture retention requirements of ASTM C309 Type 1, Class A.
    - .3 Meets the alkali resistance, acid resistance, adhesion-promoting qualities and UV light degradation properties of ASTM C1315 Type 1, Class A.
    - .4 VOC content: < 250 g/L.
  - .2 Phosphoric Acid Room:
    - .1 In accordance with Section 09 96 35 - Chemical Resistant Coatings.
    - .2 Ensure compatibility of chemical hardeners and curing compounds with chemical resistant coating to be applied in Phosphoric Acid Room. Requirements for substrate preparation shall be in accordance with chemical resistant coating manufacturer's instructions.
- .13 Other concrete materials: to CSA A23.1/A23.2.
- .14 Formwork materials:
  - .1 Use wood and wood product formwork materials to CAN/CSA O86 and CSA O121.
  - .2 Form release agent: Proprietary, non-volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non-petroleum containing, non-toxic, biodegradable, and low VOC.
- .15 Form ties:
  - .1 Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes minimum 25 mm diameter in concrete surface.
- .16 Rigid insulation board: per Section 07 21 13 - Board Insulation.
- .17 Vapour Barrier: In accordance with Sections 07 26 00 - Vapour Retarders.

## 2.4 MIXES

- .1 Alternative 1 - Performance Method for Specifying Concrete: To meet DCC Representative's performance criteria to CSA A23.1/CSA A23.2:
  - .1 Ensure materials used in concrete mix have been submitted for testing and meet requirements of CSA A23.1/A23.2.
  - .2 Concrete supplier to meet performance criteria as established below and verify compliance in accordance with the quality control plan.
  - .3 Provide concrete mix for exterior pads and slab foundations to meet the following requirements:
    - .1 Workability: Free of surface blemishes, loss of mortar, colour variations, and segregation.

- .2 Durability and class of exposure: C-1.
- .3 Compressive strength at 56 days age: Minimum 35 MPa.
- .4 Aggregate: normal-density, maximum size 20 mm.
- .5 Admixture: air-entraining to CSA A23.1/A23.2.
- .6 Air content: 5 to 8%.
- .7 Water: to CSA A23.1/A23.2, maximum 0.4 water-to-cement ratio.
- .8 Slump: at time and point of discharge  $75 \pm 20$  mm.
- .4 Provide concrete mix for sidewalks to meet the following requirements:
  - .1 Workability: Free of surface blemishes, loss of mortar, colour variations, and segregation.
  - .2 Durability and class of exposure: C-2.
  - .3 Compressive strength at 28 days age: Minimum 32 MPa.
  - .4 Aggregate: normal-density, maximum size 20 mm.
  - .5 Admixture: air-entraining to CSA A23.1/A23.2.
  - .6 Air content: 5 to 8%.
  - .7 Water: to CSA A23.1/A23.2, maximum 0.45 water-to-cement ratio.
  - .8 Slump: at time and point of discharge  $80 \pm 30$  mm.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Obtain DCC Representative's written acceptance before placing concrete:
  - .1 Provide 24 hours' notice before each concrete pour.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Concrete delivery and handling to facilitate placing with minimum of rehandling, and without damage to existing structure or Work.
- .4 Pumping of concrete permitted only after approval of equipment and mix.
- .5 Do not permit vertical free fall of concrete mix to exceed 1,500 mm.
- .6 Disturbing reinforcement and inserts during concrete placement is prohibited.
- .7 Before placing of concrete obtain DCC Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .8 Protect previous Work from staining.
- .9 Clean and remove stains before application of concrete finishes.
- .10 Maintain accurate records of poured concrete items. Indicate date, location of pour, quality, workability, air content, temperature, and test samples taken.
- .11 Do not place load upon new concrete until authorized by DCC Representative.



- .12 Do not place concrete until all buried services have been installed and tested.
- .13 Concrete trucks or any other vehicles are not permitted to drive on reinforcing mats.
- .14 Ensure that foundation bearing materials are free from water and frost. Remove previously frozen bearing materials.

### 3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Examination: verify elevations as indicated on Drawings.
- .3 Fabricate and erect formwork in accordance with CAN/CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2:
  - .1 Align form joints and make watertight.
  - .2 Keep form joints to minimum.
- .4 Sleeves and inserts:
  - .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers, and other inserts required built-in.
  - .2 Sleeves and openings minimum 100 mm x 100 mm not indicated, to be reviewed by DCC Representative.
  - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written acceptance of modifications from the DCC Representative before placing concrete.
  - .4 Confirm locations and sizes of sleeves and openings shown on Drawings.
- .5 Anchor Bolt Installation:
  - .1 Set anchor bolts to templates in coordination with appropriate Subcontractor before placing concrete.
  - .2 Post-install anchor bolts in drilled holes after concrete has set only after receipt of written approve from DCC Representative and in accordance with Section 05 05 19 - Post-Installed Anchors:
    - .1 Drilled holes: To manufacturer's recommendations, minimum 25 mm diameter larger than bolts used.
    - .2 Protect anchor bolt holes from water accumulation and snow and ice build-ups.
- .6 Grout Installation Under Base Plates and Machinery: Use procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .7 Joint Sealant:
  - .1 Seal sawcut and construction joints with approved sealant.
  - .2 Application, including substrate preparation and curing, in accordance with manufacturer's instructions.

- .8 Vapour barrier:
  - .1 Install vapour barrier under concrete slabs-on-grade inside building in accordance with Section 07 26 00 - Vapour Retarder.
  - .2 Install in accordance with manufacturer's recommendations, laid smooth without folds or bunches of material.
  - .3 Lap at joints and seal.
  - .4 Seal punctures before placing concrete.
  - .5 Use patching material larger than puncture and seal.
  - .6 Seal all pipe and conduit penetrations through the membrane
  - .7 Ensure items that pass through membrane are properly and rigidly installed.
- .9 Leave formwork in place for following minimum periods of time after placing concrete:
  - .1 5 days for pads and slab foundations.
  - .2 Remove formwork when concrete has reached 70% of its 56 day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
  - .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
  - .4 Re-use formwork and falsework subject to requirements of CSA A23.1/A23.2.

### 3.3 FINISHING AND CURING

- .1 Finish concrete to CSA A23.1/CSA A23.2.
- .2 Use procedures reviewed by the CSA A23.1/CSA A23.2 to remove excess bleed water. Ensure surface is not damaged.
- .3 Use curing compounds free of bonding agents and to CSA A23.1/A23.2.
- .4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
- .5 Interior floor slabs to be left exposed: initial finishing operations followed by final finishing comprising mechanical floating and steel troweling in accordance with CSA A23.1/A23.2 Table 21 to produce hard, smooth, dense steel trowelled surface free from blemishes; finish classification Class C.
- .6 Apply chemical floor hardener and sealing compounds:
  - .1 Apply floor treatments in accordance with manufacturer's written instructions.
- .7 Equipment pads: Trowel smooth followed by light broom non-slip finish.
- .8 Pavements, walks, curbs, and exposed site concrete:
  - .1 Screed to plane surfaces and use wood, aluminum, or magnesium floats.
  - .2 Provide round edges and joint spacings using standard tools.
  - .3 Trowel smooth and provide lightly brushed non-slip finish.

### **3.4 CONTROL JOINTS**

- .1 Sawcut control joints in slabs on grade at locations indicated, to CSA A23.1/A23.2 and install specified joint sealer/filler:
  - .1 Sawcut by soft-cut method as early as practicable or alternatively use the wet method, no sooner than twelve (12) hours and no later than twenty-four (24) hours after concrete placement. Ensure that reinforcement and work of other sections are located below cutting line.

### **3.5 CONSTRUCTION JOINTS**

- .1 Construction joint locations shall be approved by the DCC Representative wherever they are not specifically designated on the drawings.
- .2 Construction joints shall be keyed and dowelled. Refer to typical construction joints detailed on drawings.
- .3 Surface of concrete construction joints shall be cleaned and laitance removed.
- .4 Immediately before new concrete is placed, all construction joints shall be wetted and standing water removed.
- .5 Locate construction joints so as to least impair the strength of the structure and to the DCC Representative's approval.

### **3.6 SITE TOLERANCES**

- .1 Tolerances to CSA A23.1/A23.2.

### **3.7 SITE QUALITY CONTROL**

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in Section 01 33 00 - Submittal Procedures:
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7 and 28 days.
  - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials carried out by testing laboratory designated by DCC Representative for review to CSA A23.1/A23.2:
  - .1 Ensure testing laboratory certified to CSA A283.
  - .2 Third party inspection and testing services to be retained and paid for by the Contractor.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and DCC Representative.
- .4 Contractor will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Inspection or testing by DCC Representative not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

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

### **3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate cleaning area for tools to limit water use and runoff.
- .4 Cleaning of concrete equipment in accordance with Section 01 35 43 - Environmental Protection.
- .5 Waste Management: separate waste materials for recycle:
  - .1 Concrete trucks shall not be washed on DND property.
  - .2 Divert admixtures and additive materials from landfill to approved official hazardous material collections site after receipt of written approval from DCC Representative.
  - .3 Disposal of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground, or in other location posing health or environmental hazard is prohibited.
  - .4 Using appropriate safety precautions, collect liquid, or solidify liquid with inert, noncombustible material, and remove for disposal.

**END OF SECTION**

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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1    Section 03 30 00.09 - Cast-in-Place Concrete - Short Form.
- .2    Section 04 05 13 - Masonry Mortaring and Grouting.
- .3    Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .4    Section 04 05 23 - Masonry Accessories.
- .5    Section 04 22 00 - Concrete Unit Masonry.
- .6    Section 07 92 00 - Joint Sealants.

**1.2               REFERENCE STANDARDS**

- .1    CSA Group (CSA):
  - .1    CSA A165 Series-14 (R2024), CSA Standards on Concrete Masonry Units.
  - .2    CAN/CSA-A179-14 (R2024), Mortar and Grout for Unit Masonry.
  - .3    CAN/CSA-A371-14 (R2024), Masonry Construction for Buildings.

**1.3               ADMINISTRATIVE REQUIREMENTS**

- .1    Coordination:
  - .1    Coordinate with Section 04 05 13 – Masonry Mortaring and Grouting, Section 04 05 19 – Masonry Anchorage and Reinforcing, and Section 04 05 23 – Masonry Accessories.
  - .2    Coordinate with the Sections described in Part 2.
- .2    Pre-Installation Meetings: Conduct a meeting a minimum one week before beginning masonry installation to:
  - .1    Verify Project requirements.
  - .2    Verify minimum acceptable substrate conditions, established during review of mock-up, required for performance of work.
  - .3    Coordinate products and installation methods.
  - .4    Coordinate mortar and grout testing.
  - .5    Sequence work of related Sections.
  - .6    Coordinate lines, levels, and coursing with other affected Subcontractors.
  - .7    Obtain items to be built-in before beginning masonry work.
  - .8    Review manufacturer's installation instructions.
  - .9    Review masonry cutting tools, methods, and temporary barriers and review safety and protection requirements from dust during cutting operations.
  - .10   Review methods to prevent excess mortar from entering cavity space, and method for removing excess mortar from cavity space.
  - .11   Review methods for controlling efflorescence during construction.

- .12 Review warranty requirements.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit the following action submittals before starting work of this Section:
  - .1 Product Data: Product literature and data sheets for installed products, including product characteristics, performance criteria, physical sizes, finishes, WHMIS SDS, and limitations.
- .3 Submit the following information submittals as work progresses:
  - .1 Test and Evaluation Reports:
    - .1 Test reports to certify compliance of masonry units with specified performance characteristics and physical properties.
    - .2 Submit data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.
  - .2 Manufacturers' Instructions: Indicate special storage and handling requirements, installation instructions and sequence, and cleaning procedures. Keep a copy onsite during installation.

#### **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: experienced in performing work of this Section who has specialized in installation of work similar to that required for this project.
  - .2 Masons: company or person specializing in masonry installations with experience in masonry work similar to this project.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements, CAN/CSA-A179, and CAN/CSA-A371.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors in a clean area, and in accordance with manufacturer's recommendations.
  - .2 Keep materials dry until use, except where wetting of bricks or blocks is specified.
  - .3 Deliver and handle masonry units to avoid chipping and staining.
  - .4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

#### **1.7 SITE CONDITIONS**

- .1 Ambient Conditions: Assemble and install components when temperatures are above 4 °C.

- .1 Cold weather protection and construction requirements: To CAN/CSA-A371, and:
  - .1 Maintain temperature of mortar between 4 °C and 50 °C until batch is used or becomes stable.
  - .2 Maintain ambient temperature of masonry work and its constituent materials between 4 °C and 50 °C and protect area of work from windchill.
  - .3 Maintain temperature of masonry above 0 °C for a minimum of 7 days after mortar is installed.
  - .4 Preheat unheated wall sections in enclosure to above 10 °C for a minimum 72 hours before applying mortar.
- .2 Hot Weather Requirements: To CAN/CSA-A371, and:
  - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
  - .3 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.
  - .4 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

## **1.8 WARRANTY**

- .1 For work in this Section, 12 months warranty period is required.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Masonry materials are specified in the following Sections:
  - .1 Section 04 05 13 - Masonry Mortaring and Grouting.
  - .2 Section 04 05 23 - Masonry Accessories.
  - .3 Section 04 05 19 - Masonry Anchorage and Reinforcing.
  - .4 Section 04 22 00 - Concrete Unit Masonry.
  - .5 Section 07 92 00 - Joint Sealants.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions:
  - .1 Verify site conditions are acceptable, can be maintained, and areas are ready to receive work.
  - .2 Built-in items are in proper location, and ready for roughing into masonry work.
  - .3 Commencing installation means acceptance of in place substrates.

### 3.2 PREPARATION

- .1 Surface Preparation: Prepare surface in accordance manufacturer's written recommendations.
- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent materials from damage and disfiguration.

### 3.3 INSTALLATION

- .1 Perform masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- .4 Exposed Masonry:
  - .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry in accordance with CSA A165 series and replace with undamaged units.
- .5 Installation - Joints:
  - .1 Allow joints to set just enough to remove excess water or "thumbprint" hard, then tool with round jointer to provide smooth, compressed, uniformly concave joints true-to-line.
- .6 Cutting:
  - .1 Cut-out for electrical switches, outlet boxes, and other recessed or built-in objects.
  - .2 Make cuts straight, clean, and free from uneven edges.
- .7 Building-In:
  - .1 Build-in items required to be built into masonry.
  - .2 Prevent displacement of built-in items during construction. Check plumb, location, and alignment frequently, as work progresses.
  - .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
- .8 Wetting of Bricks:
  - .1 Except in cold weather, wet bricks having initial rate of absorption exceeding 1 g/minute/1,000 mm<sup>2</sup>: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
  - .2 Wet tops of brick walls qualifying for wetting when recommencing work on such walls.
- .9 Support of Loads:
  - .1 Use 30 MPa concrete to Section 03 30 00.09 - Cast-in-Place Concrete - Short Form, where concrete fill is used instead of solid units.



- .2 Install building paper below voids to be filled with grout. Keep paper 25 mm back from faces of units.
- .10 Provision for Movement:
  - .1 Leave 6 mm space between top of non-loadbearing walls and partitions and structural elements. Do not use wedges.
  - .2 Build masonry to tie in with stabilizers, with provision for vertical movement.
- .11 Installation - Control Joints:
  - .1 Construct continuous control joints as indicated on Drawings.
- .12 Installation - Movement Joints:
  - .1 Build-in continuous movement joints as indicated on Drawings.
- .13 Interface with Other Work:
  - .1 Cut openings in existing work as indicated on Drawings.
  - .2 Openings in walls: Reviewed by DCC Representative.

### 3.4 TOLERANCES

- .1 Install masonry to tolerances in CAN/CSA-A371, except:
  - .1 Vertical alignment at external corners and door jambs should not vary from plumb by more than 3 mm in 3,000 mm and should not exceed 13 mm over the entire masonry wall height.

### 3.5 SITE QUALITY CONTROL

- .1 Site Tests, Inspection:
  - .1 Perform site inspection and testing in accordance with Section 01 45 00 - Quality Control.
  - .2 Notify inspection agency minimum 24 hours in advance of requirement for tests.
- .2 Manufacturer's Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, and protection of its products, and submit written reports in acceptable format to verify compliance of work with Contract.
  - .2 Manufacturer's site services: provide manufacturer's site services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
  - .3 Schedule site visits with DCC Representative to review work as installation is about to begin.
  - .4 Schedule site visits with DCC Representative to review work at stages listed:
    - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
    - .2 Twice during progress of work at 25% and 60% complete.
    - .3 Upon completion of work, after cleaning is carried out.

- .5 Obtain reports within 3 days of review and submit immediately to DCC Representative.

### **3.6 CLEANING**

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

### **3.7 PROTECTION**

- .1 Temporary Bracing:
  - .1 Provide temporary bracing and support of masonry work during and after erection until permanent lateral support is in place.
  - .2 Brace and support masonry walls as necessary to resist wind pressures, lateral forces, and temporary construction loads 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 masonry work not otherwise enclosed or sheltered with waterproof covering at end of each Work Day. Secure coverings in position.
- .3 Air Temperature Protection: Protect completed masonry in accordance with CAN/CSA-A371 and SITE CONDITIONS in PART 1 of this Section.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 04 05 00 - Common Work Results for Masonry.
- .2    Section 04 05 19 - Masonry Anchorage and Reinforcing.

**1.2            REFERENCE STANDARDS**

- .1    CSA Group (CSA):
  - .1    CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2    CAN/CSA-A179-14 (R2024), Mortar and Grout for Unit Masonry.
  - .3    CAN/CSA-A371-14 (R2024), Masonry Construction for Buildings.
  - .4    CAN/CSA-A3000-23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .2    International Masonry Industry All-Weather Council (IMIAC):
  - .1    Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature, and data sheets for masonry mortar and grout and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2    Submit 2 copies of WHMIS SDS. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).
- .3    Manufacturers' Instructions: submit manufacturer's installation instructions.

**1.4            QUALITY ASSURANCE**

- .1    Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2    Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.5            DELIVERY, STORAGE, AND HANDLING**

- .1    Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's instructions.
- .2    Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect masonry mortar and grout packages from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **1.6 SITE CONDITIONS**

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
  - .1 Minimum 10 °C prior to, during, and 48 hours after completion of masonry work.
  - .2 Maximum 32 °C prior to, during, and 48 hours after completion of masonry work.
- .2 Weather Requirements: CAN/CSA-A371 and International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
  - .1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10) gray colour:
    - .1 Use low VOC products.
  - .2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA-A179, Type S.
  - .3 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA-A179, Type S:
    - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
  - .4 Packaged Dry Combined Materials for mortar: to CAN/CSA-A179, Type S, using gray colour cement.
- .3 Aggregate: supplied by one supplier:
  - .1 Fine Aggregate: to CAN/CSA-A179, natural sand.
  - .2 Course Aggregate: to CAN/CSA-A179
- .4 Water: clean and potable.
- .5 Lime:
  - .1 Quick Lime: to CAN/CSA-A179, Type S.
- .6 Bonding Agent: epoxy type.
- .7 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

## **2.2 MORTAR MIXES**

- .1 Mortar for exterior masonry above grade:
  - .1 Load Bearing: type S based on property specifications.
- .2 Mortar for interior masonry:
  - .1 Non-Load Bearing: S based on property specifications.
- .3 Pointing Mortar: CAN/CSA-A179, Type S using property specification with maximum 2 percent ammonium stearate or calcium stearate per cement weight.

## **2.3 MORTAR MIXING**

- .1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to within 1% accuracy.
- .2 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.
- .3 Maintain sand uniformly damp immediately before mixing process.
- .4 Add mortar colour and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and colouration.
- .5 Using anti-freeze compounds including calcium chloride or chloride based compounds is prohibited.
- .6 Adding air entraining admixture to mortar mix is prohibited.
- .7 Use a batch type mixer in accordance with CAN/CSA-A179.
- .8 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.
- .9 Use mortar within 2 hours after mixing at temperatures of 32 °C, or 2-1/2 hours at temperatures under 10 °C.

## **2.4 GROUT MIXES**

- .1 Bond Beams: grout mix 15 MPa strength at 28 days; 200-250 mm slump; mixed in accordance with CAN/CSA-A179.
- .2 Lintels: grout mix 15 MPa strength at 28 days; 200-250 mm slump; mixed in accordance with CAN/CSA-A179.
- .3 Grout: Minimum compressive strength of 15 MPa at 28 days. Maximum aggregate size and grout slump: CAN/CSA-A179

## **2.5 GROUT MIXING**

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

## **2.6 MIX TESTS**

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

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

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

### **3.3 CONSTRUCTION**

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

### **3.4 MIXING**

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

### **3.5 MORTAR PLACEMENT**

- .1 Install mortar to manufacturer's instructions.
- .2 Install mortar to requirements of CAN/CSA-A179.
- .3 Remove excess mortar from grout spaces.

### **3.6 GROUT PLACEMENT**

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

### **3.7 FIELD QUALITY CONTROL**

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

### **3.8 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.

### **3.9**

#### **PROTECTION**

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

**END OF SECTION**



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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 04 05 00 - Common Work Results for Masonry.
- .2      Section 04 05 13 - Masonry Mortaring and Grouting.
- .3      Section 04 05 23 - Masonry Accessories.
- .4      Section 04 22 00 - Concrete Unit Masonry.

**1.2               REFERENCE STANDARDS**

- .1      ASTM International (ASTM):
  - .1      ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
  - .2      ASTM A82-02, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .3      ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - .4      ASTM A580/A580M-16, Standard Specification for Stainless Steel Wire.
  - .5      ASTM A641/A641M-19, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .6      ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - .7      ASTM A1022 16B, Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement.
  - .8      ASTM F1554-20, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- .2      CSA Group (CSA):
  - .1      CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2      CAN/CSA-A179-14 (R2024), Mortar and Grout for Unit Masonry.
  - .3      CAN/CSA-A370-14 (R2023), Connectors for Masonry.
  - .4      CAN/CSA-A371-14 (R2024), Masonry Construction for Buildings.
  - .5      CSA G30.18-21, Carbon Steel Bars for Concrete Reinforcement.
  - .6      CSA S304-14 (R2019), Design of Masonry Structures.
  - .7      CSA W186-21, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3      Reinforcing Steel Institute of Canada (RSIC):
  - .1      Reinforcing Steel Manual of Standard Practice, 2020.

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

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

- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for anchorage and reinforcing materials and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit 2 copies of WHMIS SDS.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
  - .2 Submit drawings detailing bar bending details, anchorage details lists, and placement drawings
  - .3 On placement drawings, indicate sizes, spacing, location, and quantities of reinforcement and connectors.
- .4 Manufacturers' Instructions: submit manufacturer's installation instructions.

#### **1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### **1.5 SITE MEASUREMENTS**

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

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

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

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Bar reinforcement: Steel to CAN/CSA-A371 and CSA G30.18, Grade 400.
- .2 Connectors: to CAN/CSA-A370 and CSA S304.1.

- .3 Corrosion protection: to CSA S304.1, galvanized to CSA S304.1 and CAN/CSA-A370.
- .4 Fasteners: installed post-construction:
  - .1 Screw Shields and Plugs: plastic, vibration-resistant, chemical-resistant, water-resistant, install in mortar joints.
  - .2 Bolts and Screws: size and type to suit application, locate where indicated.
  - .3 Nails: case-hardened cut or spiral nails, size, and type to suit fastening application.
  - .4 Powder-Driven Fasteners: pin styles and lengths to suit fastening application in accordance with manufacturers use, load, and hold recommendations.
  - .5 Adhesives: epoxies, mastics and contact cements for fastening applications, use in accordance with manufacturers' recommendations.
- .5 Ties: hot dip galvanized to CAN/CSA-A370 Table 5.2 steel finish:
  - .1 Corrugated to: CAN/CSA-A370.
  - .2 Joint Reinforcement Ties: CSA A371 with corrosion protection to CSA S304 and CSA A370:
    - .1 Single Wythe Joint Reinforcement: truss type:
      - .1 Steel wire, hot dip galvanized: to ASTM A641, Class 3 after fabrication.
      - .2 Cold drawn steel wire.
- .6 Anchors: to CAN/CSA-A370:
  - .1 Conventional Anchors: type plate anchors, shape J, sized to suit application.
  - .2 Wedge Anchors: expansion anchors type wedge and bolt, sized to suit application.
  - .3 Sleeve Anchors: type sleeve and bolt, sized to suit application.
  - .4 Dovetail Anchors: bent steel strap, galvanized to CAN/CSA-A370 Table 5.2 coated finish.
  - .5 Anchor Bolts: conventional (unpatented) anchors, steel, galvanized to CAN/CSA-A370 Table 5.2 coated finish.
- .7 Conventional Bolts:
  - .1 Bolts: to ASTM A36, bar stock shop threaded, bent bar anchors, J shaped.
  - .2 Plate anchors: steel to ASTM A36, weld square of circular steel plate perpendicular to axis of steel bar threaded on opposite end.
  - .3 Through bolt rods: to ASTM A307 threaded rod or threaded ASTM A36 bar stock.

## 2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CAN/CSA-A370.

- .3 Obtain DCC Representative's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Ship reinforcement and connectors, clearly identified in accordance with drawings.

## **2.3 SOURCE QUALITY CONTROL**

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

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

- .1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.

### **3.3 INSTALLATION**

- .1 Supply and install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371, CSA A23.1/A23.2, and CSA S304.1 unless indicated otherwise.
- .2 Prior to placing mortar and grout, obtain DCC Representative's approval of placement of reinforcement and connectors.
- .3 Supply and install additional reinforcement to masonry as indicated.

### **3.4 BONDING AND TYING**

- .1 Tie masonry veneer to backing in accordance with the National Building Code of Canada (NBC), CSA S304.1, CAN/CSA-A371 and as indicated.
- .2 Install unit, adjustable, single wythe and multiple wythe joint reinforcement where indicated and in accordance with CAN/CSA-A370 and CAN/CSA-A371 and manufacturer's instructions:
  - .1 Install horizontal joint reinforcement 400 mm on centre.
  - .2 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
  - .3 Place joint reinforcement continuous in first and second joint below top of walls.
  - .4 Lap joint reinforcement ends minimum 150 mm.

- .5 Connect stack bonded unit joint corners and intersections with strap anchors 400 mm on centre.

### **3.5 REINFORCED LINTELS AND BOND BEAMS**

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

### **3.6 GROUTING**

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

### **3.7 ANCHORS**

- .1 Supply and install metal anchors in accordance with CAN/CSA-A370 and CAN/CSA-A371.

### **3.8 LATERAL SUPPORT AND ANCHORAGE**

- .1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

### **3.9 MOVEMENT JOINTS**

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

### **3.10 FIELD BENDING**

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

### **3.11 SITE QUALITY CONTROL**

- .1 Site inspections in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Obtain DCC Representative approval of placement of reinforcement and connectors, prior to placing mortar and grout.

### **3.12 FIELD TOUCH-UP**

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

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**3.13 CLEANING**

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

**END OF SECTION**

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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 04 05 00 - Common Work Results for Masonry.
- .2      Section 04 05 19 - Masonry Anchorage and Reinforcing.

**1.2               REFERENCE STANDARDS**

- .1      ASTM International (ASTM):
  - .1          ASTM D2240-15, Standard Test Method for Rubber Property - Durometer Hardness.
- .2      CSA Group (CSA):
  - .1          CAN/CSA-A371-14 (R2024), Masonry Construction for Buildings.

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.4               SITE MEASUREMENTS**

- .1      Make site measurements necessary to ensure proper fit of members.

**1.5               DELIVERY, STORAGE, AND HANDLING**

- .1      Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2      Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3      Storage and Handling Requirements:
  - .1          Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2          Store and protect masonry accessories from nicks, scratches, and blemishes.
  - .3          Replace defective or damaged materials with new.

**Part 2            Products**

**2.1               MATERIALS**

- .1      Movement joint filler: purpose-made elastomer 70 durometer hardness to ASTM D2240 of size and shape indicated:
  - .1          Use low VOC products.

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**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                INSTALLATION: MATERIALS**

- .1      Install continuous movement joint fillers in movement joints at locations indicated on drawings.

**3.3                CLEANING**

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

**END OF SECTION**



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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 04 05 00 - Common Work Results for Masonry.
- .2    Section 04 05 13 - Masonry Mortaring and Grouting.
- .3    Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .4    Section 04 05 23 - Masonry Accessories.

**1.2            REFERENCE STANDARDS**

- .1    CSA Group (CSA):
  - .1    CAN/CSA-A165 Series-14 (R2024), CSA Standards on Concrete Masonry Units consists: A165.1, A165.2, A165.3.
  - .2    CAN/CSA-A371-14 (R2024), Masonry Construction for Buildings.
  - .3    CSA S304-14 (2019), Design of Masonry Structures.
- .2    National Research Council Canada (NRC):
  - .1    National Building Code of Canada 2020 (NBC).

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.4            QUALITY ASSURANCE**

- .1    Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2    Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3    Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 - Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions, and manufacturer's warranty requirements.

**1.5            DELIVERY, STORAGE, AND HANDLING**

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

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

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Standard concrete block units: to CAN/CSA-A165 Series ( CAN/CSA-A165.1):
  - .1 Classification: H/15/A/M.
  - .2 Dimensions Nominal: 200 mm wide x 200 mm high x 400 mm long.
  - .3 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels, beams, and bond beams. Provide additional special shapes as indicated.

### **2.2 REINFORCEMENT**

- .1 Reinforcement in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

### **2.3 CONNECTORS**

- .1 Connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

### **2.4 MORTAR MIXES**

- .1 Mortar and mortar mixes in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

### **2.5 GROUT MIXES**

- .1 Grout and grout mixes in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

## **2.6 CLEANING COMPOUNDS**

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

## **2.7 TOLERANCES**

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

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

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

### **3.3 INSTALLATION**

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

- .4 Install special site cut shaped units.

### **3.4 REINFORCEMENT**

- .1 Install reinforcing in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

### **3.5 CONNECTORS**

- .1 Install connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

### **3.6 MORTAR PLACEMENT**

- .1 Place mortar in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

### **3.7 GROUT PLACEMENT**

- .1 Place grout in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

### **3.8 CONSTRUCTION**

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

### **3.9 REPAIR/RESTORATION**

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

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**3.10 SITE QUALITY CONTROL**

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
- .2 Manufacturer's Field Services: in accordance with Section 04 05 00 - Common Work Results for Masonry.

**3.11 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day.
  - .2 Standard Concrete Unit Masonry:
    - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.

**3.12 PROTECTION**

- .1 Brace and protect concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00.09 - Cast-In-Place Concrete - Short Form.
- .3 Section 04 05 00 - Common Work Results for Masonry.
- .4 Section 04 05 19 - Masonry Anchorage and Reinforcing.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures
- .2 Product Data:
  - .1 Submit manufacturer's instructions and manufacturer's specifications with recommended design values and physical characteristics for epoxy dowels, expansion, and undercut anchors.
- .3 Installer Qualifications & Procedures:
  - .1 Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.
- .4 Closeout Submittal: Submit the following:
  - .1 Record Documents: Project record documents for installed materials in accordance with Section 01 78 00 - Closeout Submittals.

**1.3 QUALITY ASSURANCE**

- .1 Installer Qualifications
  - .1 Post-installed anchors shall be installed by personnel with experience performing work of comparable complexity and scope using similar equipment and procedures.
- .2 Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
  - .1 Hole drilling procedure.
  - .2 Hole preparation & cleaning technique.
  - .3 Adhesive injection technique & dispenser training/maintenance.
  - .4 Proof loading/torquing.
- .3 Anchor installer certification is required for all installers of adhesive anchors in horizontal or upwardly inclined orientation. The ACI Adhesive Anchor Installer Certification or Hilti Adhesive Anchor Installer Certification Program (HAAICP) shall be considered an acceptable training to meet this requirement. For alternate certification procedures, the Contractor shall submit the training content and trainer qualification to

the DCC Representative for approval prior to commencement with the adhesive anchor installer certification.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Fasteners and Anchors:
  - .1 Bolts and Studs: ASTM A307; ASTM A449 where "high strength" is indicated on the Drawings.
  - .2 Carbon and Alloy Steel Nuts: ASTM A563.
  - .3 Carbon Steel Washers: ASTM F436.
  - .4 Carbon Steel Threaded Rod: ASTM F1554 Grade 36, or ASTM F1554 Grade 55, or ASTM F1554 Grade 105.
  - .5 Hot-Dip Galvanizing: ASTM A153.
  - .6 Reinforcing Steel: Billet steel, grade 400, deformed bars to CSA G30.18, unless indicated otherwise.

#### **2.2 DRILLED-IN ANCHORS**

- .1 Wedge Anchors
  - .1 Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings. Size as indicated on drawings with type to achieve design loads indicated on drawings.
  - .2 Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
- .2 Screw Anchors
  - .1 Screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Size as indicated on drawings with type to achieve design loads indicated on drawings.

- .2 Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8 mm min.).
- .3 Cartridge Injection Adhesive Anchors:
  - .1 Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Size as indicated on drawings with type to achieve design loads indicated on drawings.
  - .2 Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM F1554 Grade 55 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
  - .3 Exterior Use: As indicated on the Drawings, provide hot-dip galvanized bolts and associated nuts and washers in accordance with ASTM A153 or as otherwise indicated as compatible with adhesive manufacturer's printed literature.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Drill holes with rotary impact hammer drills using carbide-tipped bits, hollow drill bit system, or core drills using diamond core bits, as indicated in manufacturer's installation instructions. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
- .2 Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the DCC Representative if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
- .3 Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- .4 Perform anchor installation in accordance with manufacturer instructions.
- .5 Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the DCC Representative.
- .6 Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular



gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

- .7 Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.
- .8 Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

### **3.2 FIELD QUALITY CONTROL**

- .1 Testing: If requested by DCC Representative, 10% of each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors shall not be torque tested unless otherwise directed by the DCC Representative. If any of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the DCC Representative:
  - .1 Tension testing should be performed in accordance with ASTM E488.
  - .2 Proof loads shall be applied with a calibrated hydraulic ram.
- .2 Minimum anchor embedments shall be as shown on the Drawings.

### **3.3 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 08 99 - Rough Carpentry for Minor Works.
- .2 Section 06 17 53 - Shop-Fabricated Wood Trusses.

**1.2 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 ASTM A123/A123M- 13 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A153/A153M- 09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .3 ASTM A480/A480M- 20 Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .4 ASTM A653/A653M- 13 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5 ASTM A1003/A1003M- 15, Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
  - .6 ASTM F593- 17, Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
  - .7 ASTM F1428-92 2017, Standard Specification for Aluminum Particle-Filled Basecoat/Organic or Inorganic Topcoat Corrosion Protective Coatings for Fasteners.
  - .8 ASTM F1667- 13, Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
  - .9 ASTM F2329/F2329M- 15 Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
- .2 CSA Group (CSA):
  - .1 CSA G40.20-13/G40.21-13 (R2023), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-O80 Series- 15 (R2020), Wood Preservation.
  - .3 CSA O322- 15 (R2020), Procedure for Certification of Pressure-Treated Wood Materials for Use in Preserved Wood Foundations.
- .3 Health Canada (HC):
  - .1 Pest Management Regulatory Agency (PMRA), Pesticide Information Database; Wood Preservatives.
- .4 National Lumber Grades Authority (NLGA):
  - .1 NLGA Standard Grading Rules for Canadian Lumber 2017.

- .5 Underwriters Laboratory of Canada (ULC):
  - .1 CAN/ULC-S102- 10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S102.2- 10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
- .6 American Wood-Preservers' Association (AWPA):
  - .1 AWPA M2- 19, Standard for the Inspection of Preservative Treated Products for Industrial Use.
  - .2 AWPA M4- 11, Standard for the Care of Preservative-Treated Wood Products.

### 1.3 SUBMITTALS

- .1 Submit 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 product data describing requirements for storage, instructions for use and site dressings for cut ends, and health and safety requirements for handling and disposal of specified products.
- .3 Informational Submittals (to be provided during the course of Work):
  - .1 Fastenings and Hardware:
    - .1 Submit list of fastenings and hardware proposed for use.
    - .2 Confirm size and configuration, appropriate corrosion resistance, and types of wood preservative and fire retardant treatment materials used for the Project.
  - .2 Wood Treatment Certificates - submit information for wood preservative and fire retardant treatment materials, indicating the following:
    - .1 Storage and handling requirements;
    - .2 Protection requirements, including worker health and safety and environmental protection;
    - .3 Composition of chemical treatment;
    - .4 Moisture content of materials treated with water borne chemical treatments;
    - .5 Net amount of specified treatments retained; and
    - .6 Acceptable types of paint, stain, and clear finishes that may be used over treated materials that require finishing after treatment.

## **1.4 QUALITY ASSURANCE**

- .1 Qualifications: Provide proof of qualifications when requested by DCC Representative:
  - .1 Wood Treatment Facility - obtain treated wood products from a single wood treatment facility:
    - .1 Experienced in performance of work described in this Section,
    - .2 Licensed by the chemical treatment manufacturer, and
    - .3 Certified in accordance with the Canadian Wood Preservation Certification Authority.
  - .2 Certifications (to be provided during the course of Work):
    - .1 Compliance Certification: Provide certificates from wood treatment facility indicating compliance with specified standards, processes employed during treatment, and retention of treatment values.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Carried out in accordance with Section 01 61 00 - Common Product Requirements, AWP4 M4, and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with product category, manufacturer's name, and address.

## **1.6 WARRANTY**

- .1 Special Warranty: Submit pressure treatment facility's standard warranty covering defects in material and retention of pressure treatment materials, fully transferrable to Project Owner for the following durations:
  - .1 Pressure Preservative Treated Wood: Lifetime (50+ Years Minimum).
  - .2 Start of Warranty: Substantial Performance for the Project.

## **Part 2 Products**

### **2.1 DESCRIPTION**

- .1 Regulatory Requirements:
  - .1 Preservative Registration: Use only wood treatment products that are registered with Health Canada's PMRA.
  - .2 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; and
    - .4 Grading marks required by wood Products described in Paragraph 2.3.1 below.

- .3 Fire Retardant Wood Treatments: Use only wood treatments meeting requirements of CAN/CSA-O80 Series, and that are tested in accordance with CAN/ULC-S102 or CAN/ULC-S102.2 for flame spread and smoke developed classifications. Ensure treated wood Products clearly indicate on the face or edge the following labelling requirements in accordance with Wood Preservation Canada:
  - .1 ULC Label describing flame spread and smoke developed performance ratings;
  - .2 Name of registered treatment;
  - .3 Basic safety instructions;
  - .4 Consumer safety contact information; and
  - .5 Grading marks required by wood Products described Paragraph 2.3.1 below.

## 2.2 PERFORMANCE CRITERIA

- .1 Corrosion Resistance of Fasteners and Hardware: Carbon steel, galvanized steel, aluminum, copper, or red brass in contact with treated wood must exhibit corrosion rates less than 2.5  $\mu\text{m}$  per year.
- .2 Preservative Treated Service Conditions: Indicate the following Use Categories (UC) on Drawings; coordinate and confirm material location and type before ordering pressure treated products:
  - .1 UC2 Moisture Exposed Interior Construction: Interior construction protected from weather and not in contact with ground or foundations, but exposed to occasional sources of moisture, used in locations such as interior beams, timbers framing, and sill plates in contact with exterior permeable bearing construction.
- .3 Preservative Solvents: Use waterborne or oil borne preservative treatments required by Use Categories described above and generally as follows:
  - .1 Water Based Solvents:
    - .1 Wood in contact with masonry or concrete;
    - .2 Wood within 450 mm of grade;
    - .3 Wood decking and fence boards;
    - .4 Wood in contact with flashings; and
    - .5 Wood in contact with waterproofing membranes (confirm compatibility with the membrane manufacturer before installation).
  - .2 Oil Based Solvents:
    - .1 Wood in contact with ground;
    - .2 Wood in contact with freshwater;
    - .3 Landscaping timbers;
    - .4 Retaining walls;
    - .5 Piers or docks;
    - .6 Pilings;

- .7 Bases of utility poles; and
- .8 Bases of fence posts.

## 2.3 MATERIALS

- .1 Wood Products: Coordinate with the following for species, grade, and quality requirements:
  - .1 Dimensional Lumber: For species and grade, refer to Section 06 08 99 - Rough Carpentry for Minor Works.
  - .2 Structural Plywood: For species and grade, refer to Section 06 08 99 - Rough Carpentry for Minor Works.
  - .3 Fabricated Wood: For species and grade, refer to Section 06 17 53 - Shop-Fabricated Wood Trusses.
- .2 Driven Fasteners for Treated Wood: Nails, brads, spikes, and staples; use stainless steel, hot-dip galvanized or corrosion protective coated in accordance with ASTM F1667, applicable to Use Categories described in Paragraph 2.2.2 above and wood preservative and fire retardant treatment materials used for the project.
- .3 Threaded Fasteners for Treated Wood: Screws, bolts, washers, and nuts of material type applicable to Use Categories described in Paragraph 2.2.2 above and wood preservative and fire retardant treatment materials used for the project as follows:
  - .1 Stainless Steel Fastenings: Fastenings manufactured using stainless steel, Type 304 meeting requirements of ASTM F593.
  - .2 Galvanized Steel Fastenings: Fastenings meeting requirements of ASTM F2329/F2329M, having hot-dipped galvanized coating in accordance with ASTM A153/A153M, Class C and D.
  - .3 Coated Steel Fastenings: Fastenings meeting requirements of ASTM F2329/F2329M, having corrosion protective coating in accordance with ASTM F1428, Grade 4A or 4B.
- .4 Hardware, Connectors and Hangers for Treated Wood: Hardware fabricated from sheet steel of material type required by Use Categories described in Paragraph 2.2.2 above and wood preservative and fire retardant treatment materials used for the project as follows:
  - .1 Stainless Steel Hardware: Fabricated from stainless steel sheet, plates or strips, Type 304 meeting requirements of ASTM A480/A480M.
  - .2 Galvanized Sheet Steel Hardware: Fabricated from sheet steel meeting requirements of ASTM A1003/A1003M, hot dip galvanized in accordance with ASTM A653/A653M, Coating Designation Z500.
  - .3 Galvanized Steel Hardware: Fabricated from steel plates, shapes, and bars meeting requirements of CSA G40.20/G40.21, Grade 300W, hot dip galvanized in accordance with ASTM A123/A123M.

## 2.4 PRESSURE TREATED MATERIALS

- .1 Preservative Treatments: Use the following pressure preservative treatments based on regional availability, Use Categories described in Paragraph 2.2.2 above at locations indicated on Drawings in accordance with CAN/CSA-O80, and as follows:

- .1 UC2 interior, above-ground, damp conditions: Use ACQ, MCA, or CA wood treatments.

## **2.5 ACCESSORIES**

- .1 Surface Applied Treatments: Wood treatments specific to Use Categories described Paragraph 2.2.2 above; for application to machined and cut ends, or drilled surfaces meeting the requirements of CAN/CSA-O80, and in accordance with AWWA M4.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Dimensional Lumber, Timber, and Plywood: Incorporate treated wood products into construction as described in Section 06 08 99 - Rough Carpentry for Minor Works.
- .2 Fastenings, Connectors and Hardware: Use corrosion-resistant fastenings, connectors and hardware described in this Section for specified treated wood products.
- .3 Site-Applied Preservative Treatments: Re treat surfaces exposed by cutting, trimming or drilling in accordance with of CAN/CSA-O80, and in accordance with AWWA M4, and in accordance with treatment manufacturer's written instructions.
- .4 Preparation for Site-Applied Finishes: Use fine sandpaper to remove chemical deposits on treated wood to receive applied finish.

### **3.2 CLOSEOUT ACTIVITIES**

- .1 Waste Management: Dispose of construction waste at a landfill facility licensed to accept pressure preservative treated wood products:
  - .1 Do not burn or dispose of waste on-site by burying;
  - .2 Do not recycle scrap materials;
  - .3 Do not compost scrap materials; and
  - .4 Separate waste materials from non preservative treated wood products to prevent contamination of waste stream and storm drainage system.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 06 05 73 - Wood Treatment.
- .2    Section 06 17 53 - Shop-Fabricated Wood Trusses.

**1.2            REFERENCE STANDARDS**

- .1    ASME International (ASME):
  - .1      ASME B18.6.1-1981, Wood Screws (Inch Series).
- .2    ASTM International (ASTM):
  - .1      ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
  - .2      ASTM C954 18, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
  - .3      ASTM D7612-21, Standard Practice for Categorizing Wood and Wood-Based Products According to their Fiber Sources.
  - .4      ASTM F1667-13, Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .3    CSA Group (CSA)
  - .1      CSA O86-19, Engineering Design in Wood.
  - .2      CSA O121-17 (R2022), Douglas Fir Plywood.
  - .3      CSA O141-23, Softwood Lumber.
  - .4      CSA O151-17 (R2022), Canadian Softwood Plywood.
  - .5      CSA-O325-21, Construction Sheathing.
  - .6      CSA O437 Series-93 (R2011), Standards on OSB and Waferboard.
  - .7      CAN/CSA-Z809-16, Sustainable Forest Management.
- .4    National Lumber Grades Authority (NLGA):
  - .1      NLGA Standard Grading Rules for Canadian Lumber 2022.

**1.3            SUBMITTALS**

- .1    Submit 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 instructions, printed product literature, and data sheets for rough carpentry work and include product characteristics, performance criteria, physical size, finish, and limitations.



- .3 Informational Submittals (to be provided during the course of Work):
  - .1 Material Certificates:
    - .1 Submit certificates for machine-graded and finger-jointed dimensional lumber indicating species and grade selected for each use and design values approved by the NLGA.

#### **1.4 QUALITY ASSURANCE**

- .1 Regulatory Approvals: Wood products used for sheathing and framing must clearly indicate on the face or edge the manufacturer of material, standard to which it was produced, grade of material including whether grade is visually graded or machine-stress rated, and exterior use where applicable, in accordance with listed reference standard.
- .2 Lumber Identification: Identified by grade with a stamp of an agency certified by the Canadian Lumber Standards Accreditation Board.
- .3 Plywood Identification: Identified by grade mark in accordance with applicable CSA standards.
- .4 Plywood, OSB and Wood-Based Composite Panel Construction Sheathing Identification: Identified by grade mark in accordance with applicable CSA standards.
- .5 Sustainable Standards Certification:
  - .1 Certified Wood: Submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI

#### **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: Protect materials from weather while in transit and on the jobsite.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location in clean, dry, and well-ventilated area.
  - .2 Cover with protective waterproof sheets allowing for air circulation and ventilation under the covering.
  - .3 Protect edges and corners of sheet materials from damage during handling and storage.
  - .4 Protect kiln dried and seasoned wood materials under conditions that will not cause an increase to moisture content.
  - .5 Stack, lift, brace, cut, and notch engineered lumber products in accordance with manufacturer's instructions and recommendations.
  - .6 Store separated reusable wood waste convenient to cutting station and work areas.

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**Part 2 Products**

**2.1 DESCRIPTION**

- .1 Regulatory Requirements:
  - .1 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, that conform to National Grading Rules published by the National Lumber Grades Authority, and that have the following characteristics:
    - .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.
    - .4 Sizes: Nominal dressed dimensions described in CSA O141 for surfaced dry conditions and wood species.
  - .2 Panel Grades: Provide panel products that are grade-marked by agencies recognized by CSA O325 and the National Institute of Standards and Technology, Voluntary Product Standard PS 2 04 Performance Standard for Wood-Based Structural-Use Panels as modified by other listed CSA panel standards.

**2.2 PERFORMANCE CRITERIA**

- .1 Lumber Grades: Provide lumber products as described in Paragraph 2.1.1.1 in accordance with Regulatory Requirements.
- .2 Panel Grades: Provide panel products as described in Paragraph 2.1.1.2 in accordance with Regulatory Requirements.

**2.3 MATERIALS**

- .1 Light Framing - construction grade or better with the following minimum properties:
  - .1 Sizes: Maximum 38 mm width by maximum 89 mm depth.
  - .2 Finger-Jointed Materials: Not allowed.
  - .3 Species Group: Spruce-Pine-Fir (SPF).
- .2 Miscellaneous Framing, Blocking and Strapping - standard grade or better with the following minimum properties:
  - .1 Sizes: Maximum 38 mm width by maximum 89 mm depth.
  - .2 Finger-Jointed Materials: Not allowed.
  - .3 Species Group: Spruce-Pine-Fir (SPF).

- .3 Plywood Blocking and Backing Panels:
  - .1 Douglas Fir and Canadian Softwood Plywood using exterior grade adhesives meeting requirements of CSA O121 or CSA O151; kiln dry plywood to moisture content of 15% or less, and as follows:
    - .1 Concealed Blocking: Select Grade (SEL) Canadian Softwood Plywood).
    - .2 Exposed Panels and Panel Boards: Good One Side (G1S) Douglas Fir Plywood.
- .4 DF and Canadian Softwood Plywood (CSP) using exterior grade adhesives meeting requirements of CSA O121 or CSA O151:
  - .1 Kiln dry plywood to moisture content of 15% or less.
  - .2 Concealed Blocking: Select Grade (SEL) CSP.
  - .3 Exposed Panels and Panel Boards: Good One Side (G1S) Douglas Fir Plywood.
- .5 Sheathing:
  - .1 Plywood sheathing or Oriented Strandboard (OSB) at choice of Constructor.
- .6 Thickness as required by span rating and meeting requirements of CSA O325
  - .1 Plywood: Exterior rated, sheathing grade square-edged DF or CSP meeting requirements of CSA O121 or CSA O151.
  - .2 Span Rated OSB: Exterior rated, sheathing grade OSB or waferboard meeting requirements of CSA O437 Span Rating (SR) of 32/16.
- .7 Pressure Preservative Treated Wood (PPTW): Preservative treatment of dimensional lumber and plywood, refer to Section 06 05 73 - Wood Treatment.

## **2.4 ACCESSORIES**

- .1 Driven Fasteners - steel nails, spikes, brads, and staples meeting requirements of ASTM F1667:
  - .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.
  - .5 Pressure treated materials: refer to Section 06 05 73 - Wood Treatment.
- .2 Rough Hardware: manufacturer recommended fastening devices and anchors, including bolts, nuts, and washers meeting requirements of ASTM A307:
  - .1 Ground contact materials: stainless steel.
  - .2 Exterior work: hot-dipped galvanized.
  - .3 Interior high humidity work: hot-dipped galvanized.
  - .4 Interior work: electroplated zinc plated, or cadmium plated.
  - .5 Pressure treated materials: refer to Section 06 05 73 - Wood Treatment.
- .3 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.
- .4 Screws for Fastening to Cold-Formed Metal Framing: Steel screws meeting requirements of ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- .5 Prefabricated Metal Anchoring Systems, Framing Connectors and Hangers: Prefabricated hot-dipped zinc-coated steel products tested or designed in accordance with CSA O86; types and configurations as indicated on drawings.
- .6 Proprietary Fasteners: Toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

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

#### **3.2 PREPARATION**

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and 1 minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming, or boring with liberal brush application of preservative before installation.
- .4 Treat material as indicated and as follows:
  - .1 Wood cants, fascia backing, curbs, nailers, and sleepers on roof deck.
  - .2 Wood furring on outside surface of exterior masonry and concrete walls.

#### **3.3 INSTALLATION**

- .1 Blocking, Furring and Grounds:
  - .1 Set miscellaneous rough carpentry to required levels and lines with members plumb, true-to-line, cut, and fitted.
  - .2 Fit miscellaneous rough carpentry to other construction.
  - .3 Scribe and cope as needed for accurate fit.
  - .4 Locate furring, nailers, blocking, grounds, and similar supports as required and attach to other construction.

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**3.4 CLEANING**

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

**END OF SECTION**

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**Part 1 General**

**1.1 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 Trusses.
  - .2 Pre-engineered, pre-fabricated connectors and fastenings.
  - .3 Seismic and hurricane ties.
  - .4 Accessories, blocking, and other components required for complete installation.
- .2 This Section requires delegated design, engineering analysis, and preparation of sealed and signed shop drawings performed by a qualified, supporting professional engineer registered or licensed in the Province of Ontario, Canada who is retained by the truss fabricator responsible for fabrication of wood trusses described in this Section.

**1.2 RELATED REQUIREMENTS**

- .1 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .2 Section 06 05 73 - Wood Treatment.
- .3 Section 06 08 99 - Rough Carpentry for Minor Works.

**1.3 DEFINITIONS**

- .1 Delegated Design Professional Engineer: The supporting professional engineer hired by, engaged by, or contracted to truss fabricator for the design of light metal plate connected wood trusses described in this Section. They produce signed and sealed shop drawings, are registered in the province of the Work, they are not the Consultant, and they are responsible for the following:
  - .1 Commitment to General Reviews by Architects and Engineers: Documents prepared by the supporting professional engineer indicating extent of their involvement with design solution as recommended by provincial engineering associations.
  - .2 Letter of General Conformance.
- .2 Equal Dimensions: Structural wood products and assemblies indicating equal dimensions on the Drawings shall be calculated to align with in-place structural elements followed by an even division of the space between structural elements.

**1.4 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 ASTM A653/A653M-13, 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 D7612-21, Standard Practice for Categorizing Wood and Wood-Based Products According to their Fiber Sources.
- .4 ASTM F1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .2 CSA Group (CSA):
  - .1 CSA B111 74 Wire Nails, Spikes and Staples.
  - .2 CSA O86-19, Engineering Design in Wood.
  - .3 CSA S347-14 (R2023), 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 Forest Stewardship Council (FSC):
  - .1 FSC-STD-01-001-2015, FSC Principle and Criteria for Forest Stewardship
- .4 National Lumber Grades Authority (NLGA):
  - .1 Standard Grading Rules for Canadian Lumber 2022.
  - .2 NLGA SPS-1-2023, Fingerjoined Structural Lumber.
  - .3 NLGA SPS-2-2025, Machine Graded Lumber.
  - .4 NLGA SPS-4-2024, Fingerjoined Machine Graded Lumber.
- .5 National Research Council Canada (NRC):
  - .1 National Building Code of Canada (NBC) 2020.
  - .2 Canadian Construction Materials Centre (CCMC)-on-line edition, Registry of Product Evaluations.
- .6 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 - 2024, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).
- .7 Sustainable Forestry Initiative (SFI):
  - .1 SFI-2015-2019 (extended through December 2021) SFI Forest Management Standard.

## **1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Construction Meeting: Conduct a pre-construction meeting a minimum of two (2) weeks before starting work of this Section, attended by Constructor, DCC Representative, truss fabricator, other affected subcontractors 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.

## 1.6 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 the Province of Ontario, Canada, is required to seal and sign design solutions presented in submitted shop drawings prepared under their supervision.
- .3 Placement Drawings: Submit placement and layout drawings for review by DCC Representative including the following:
  - .1 Indicate sequence of installation and erection, and temporary bracing requirements.
  - .2 Label truss and girder layouts using the same identification numbers indicated on shop drawings described in Subparagraph 1.6.2.2 above.
  - .3 Indicate hanger type used for connecting trusses.
  - .4 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 Delegated Design Submittals: Submit delegated design of shear connections, for design criteria described in Article 2.2 below. Include the following:
  - .1 Design Notes and Data: Submit supporting professional engineer's design notes and calculations verifying capacity of members, connectors for related components of the work, and that assemblies meet design requirements described in this Section.
  - .2 Submit concurrently with preliminary shop drawings indicating supporting professional engineer's limitation of design responsibilities.
  - .3 Submit concurrently with site report indicating supporting professional engineer's assessment that installation is substantially compliant with system design indicated on shop drawings.
- .4 Source Quality Control Submittals: Submit test reports for shop-fabricated wood trusses signed by supporting professional engineer registered or licensed in the Province of Ontario, Canada, or other independent testing agency acceptable to DCC Representative indicating compliance with specifications for specified performance characteristics and physical properties.
- .5 Site Quality Control Submissions: Submit truss fabricator's site services reports within three (3) days of review to DCC Representative.

## **1.7 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.

## **1.8 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.

## 1.9 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 2020 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.
- .4 Acceptable Alternate 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 joined Lumber: Provide machine-graded lumber (MSR) products meeting requirements of NLGA SPS 1 and SPS 4 acceptable to AHJ, meeting stress design requirements indicated in NBC 2020 and that are grade marked by accredited agencies of the Canadian Lumber Standards Accreditation Board and conform to National Grading Rules published by the NLGA.

## 2.2

### DESIGN CRITERIA

- .1 Design Responsibility: Truss fabricator is required to retain a supporting professional engineer registered or licensed in the Province of 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 the Province of 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:
    - .1 Design of wood truss members for Serviceability Limit States described in TPIC Truss Design Procedures, and as indicated on Drawings.
    - .2 Design and detailing of wood truss members, bracing and bridging based on design loading and spacing indicated on Drawings.
    - .3 Design and detailing of connections not specifically detailed on the Drawings.
    - .4 Details of dimensions to accommodate mechanical services passing through truss members indicated on Drawings.
    - .5 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 NBC 2020.
- .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 the Province of 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 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.

## 2.3 MATERIALS

- .1 Truss Framing: Provide wood materials meeting truss fabricator's design requirements and meeting Structural Performance Requirements listed above, and as follows:
  - .1 Sizes: Lumber sizes as described in TPIC Truss Design Procedures.
  - .2 Finger joined Materials: Not allowed.
  - .3 Grade: Provide No. 2 Grade and better materials.
  - .4 Species Group: Spruce Pine Fir (SPF).
  - .5 Selection for Appearance: Not Required.
- .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 the Province of 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; types and configurations as indicated on drawings and as follows:
  - .1 Roof Truss Tie-Downs: Brackets rated for wind uplift loads indicated above.

## **2.4 ACCESSORIES**

- .1 Wood Framing and Blocking: Provide sawn lumber materials as specified in Section 06 08 99 - Rough Carpentry for Minor Works.
- .2 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.

## **2.5 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.

## **2.6 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 nonconforming materials or variances in workmanship.
  - .5 Supporting professional engineer registered or licensed in the Province of Ontario, Canada, will direct all follow up repairs and rework and validate that trusses delivered to the Project meet specified requirements.

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**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          Inform DCC Representative of unacceptable conditions immediately upon discovery.
  - .2          Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

**3.2                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 the Province of 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 the Province of 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 the Province of 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 Schedule site visits to review work at the following stages:
    - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
    - .2 Twice during progress of work at 25% and 60% complete.
    - .3 After completion of work of this Section, and after cleaning is completed.
  - .4 Submit written reports in format acceptable to DCC Representative, to verify compliance of Work with Contract.

### 3.5 CLEANING

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



### **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**

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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1    ASTM International (ASTM):
  - .1    ASTM D449-03, Standard Specification for Asphalt Used in Dampproofing and Waterproofing.
  - .2    ASTM D6162-00a, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.
  - .3    ASTM D6163-00e1, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.
  - .4    ASTM D6164-05, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- .2    Canadian General Standards Board (CGSB):
  - .1    CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

**1.2            ADMINISTRATIVE REQUIREMENTS**

- .1    Convene preinstallation meeting one week before beginning waterproofing Work, with Waterproofing Contractor's Representative and DCC Representative to:
  - .1    Review Construction Schedule.
  - .2    Verify project requirements.
  - .3    Review installation and substrate conditions.
  - .4    Co-ordination with other building subtrades.
  - .5    Review manufacturer's installation instructions and warranty requirements.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Provide two copies of most recent technical waterproofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2    Provide two copies of WHMIS SDS and indicate VOC content for:
    - .1    Primers.
    - .2    Asphalt.
    - .3    Sealers.
    - .4    Filter fabric.
- .3    Manufacturer's Certificate: certify that products meet or exceed specified requirements.

- .4 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumens and membrane with specification requirements.
- .5 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .6 Manufacturer's site report: in accordance with Section 01 45 00 - Quality Control.

#### **1.4 QUALITY ASSURANCE**

- .1 Submit a written, signed document from the manufacturer confirming that the applicator of the sheet waterproofing membranes specified in this Section is recognized by the manufacturer as suitable for the execution of the Work.
- .2 Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Maintain one copy of manufacturer's instructions on site.
- .3 Components used in this section shall be sourced from one manufacturer, including sheet membrane, air/vapour barrier sealants, primers, mastics, and adhesives.

#### **1.5 FIRE PROTECTION**

- .1 Fire Extinguishers:
  - .1 Maintain one stored pressure rechargeable type with hose and shut-off nozzle.
  - .2 ULC labelled for A, B, and C class protection.
  - .3 Size 14 kg or as indicated on roof per torch applicator, within 6 m of torch applicator.
- .2 Maintain fire watch for 1 hour after each day's waterproofing operations cease.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Provide and maintain dry, off-ground weatherproof storage.
- .2 Store rolls of felt and membrane in upright position:
  - .1 Store membrane rolls with salvage edge up.
  - .2 Store above +5 °C.
  - .3 Membranes contain petroleum solvents and are flammable. Do not use near open flame or excessive heat.
- .3 Remove only in quantities required for same day use.
- .4 Place plywood runways over completed Work to enable movement of material and other traffic.
- .5 Store sealants at +5 °C minimum.
- .6 Store insulation protected from daylight and weather and deleterious materials.
- .7 Handle waterproofing materials in accordance with manufacturer's written directives, to prevent damage or loss of performance.

- .8 Packaging Waste Management: remove for reuse and recycle all packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Collect and separate plastic, paper packaging, and corrugated cardboard in accordance with Waste Management Plan.
  - .2 Fold up metal banding, flatten, and place in designated area for recycling.

## **1.7 SITE CONDITIONS**

- .1 Ambient Conditions
  - .1 No installation work shall be performed during rainy or inclement weather and on frost or wet covered surfaces.
  - .2 Do not install waterproofing when temperature remains below -18 °C for torch application, or to manufacturer's recommendations for mop application.
  - .3 Minimum temperature for solvent-based adhesive is -5 °C.
- .2 Install waterproofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into waterproofing system.
- .3 Protection:
  - .1 Provide adequate protection of materials and work of this Section from damage by weather backfilling operations and other causes.
  - .2 Protect work of other trades from damage resulting from work of this section. Make good such damage at own expense to satisfaction of the DCC Representative.
  - .3 Apply protection board as soon as possible after installation of membrane.

## **1.8 WARRANTY**

- .1 For Work of this Section, 12 months warranty period is extended to 60 months.

## **Part 2 Products**

### **2.1 PERFORMANCE CRITERIA**

- .1 Waterproofing System: capable of resisting moisture/water and preventing moisture migration to interior.
- .2 Compatibility between components of waterproofing system is essential. Provide written declaration to DCC Representative stating that materials and components, as assembled in system, meet this requirement.

### **2.2 PRIMER**

- .1 Primer: to CGSB 37-GP-9Ma at minimum, elastomeric bitumen, solvent primer with adhesive enhancing resins to enhance adhesion of self-adhesive membranes at temperatures above -10 °C as recommended by membrane manufacturer.

### **2.3 MEMBRANE**

- .1 Waterproofing Membrane (Select Material Based on Ambient and Contact Surface Temperatures at Time of Application): SBS modified bitumen self-adhering sheet

membrane with cross-laminated polyethylene film, covered by pull-off release sheets and as follows:

- .1 Minimum total thickness: 1.5 mm (60 mils) min.
- .2 Tensile strength (membrane): 2.24 MPa to ASTM D412.
- .3 Tensile strength (film): 34.5 MPa to ASTM D882.
- .4 Ultimate elongation: 300% to ASTM D412.
- .5 Flexibility at cold temperature: minimum -40 °C to ASTM D1970.
- .6 Vapour permeance: < 2.8 ng/Pa.s.m<sup>2</sup> ( 0.05 perms) to ASTM E96.
- .7 Puncture Resistance: 222 N min. to ASTM E154.

## **2.4 LIQUID MEMBRANE & TERMINATION SEALANT**

- .1 Termination Sealant shall be a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
  - .1 Compatible with sheet air barrier, roofing, and waterproofing membranes and substrate.
  - .2 Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
  - .3 Complies with ASTM C 920, Type S, Grade NS, Class 25.
  - .4 Elongation: 450 - 550%.
  - .5 Remains flexible with aging.
  - .6 Seals construction joints up to 25 mm (1 inch) wide.

## **2.5 ADHESIVE**

- .1 Adhesive for securing overlay board and insulation: asphalt extended vulcanized adhesive, two component unit, consisting of two liquids mixed on site to produce pourable adhesive.

## **2.6 EXTRUDED POLYSTYRENE INSULATION**

- .1 Refer to Section 07 21 13 - Board Insulation.

## **2.7 SEALERS**

- .1 As recommended by Manufacturer of Waterproofing membrane.

## **2.8 FILTER FABRIC**

- .1 UV resistant, black woven water pervious polyolefin fabric for installation between insulation and stone ballast in protected membrane system. Fabric to meet approval of insulation manufacturer:
  - .1 Product weight 93.5 gm/m<sup>2</sup>.

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**Part 3            Execution**

**3.1                QUALITY OF WORK**

- .1      Do priming for asphalt waterproofing in accordance with manufacturer's written recommendations.
- .2      Assembly, component, and material connections will be made in consideration of appropriate design loads, with reversible mechanical attachments.

**3.2                MANUFACTURER'S INSTRUCTIONS**

- .1      Compliance: comply with manufacturer's printed installation instructions, technical datasheets, and specifications.

**3.3                COORDINATION**

- .1      Coordinate Work with other trades as required to maintain Project schedule.

**3.4                VERIFICATION**

- .1      Verify that surfaces and conditions are ready to accept the Work of this Section. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.

**3.5                PREPARATION**

- .1      All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar, frost, or other contaminants. Fill spalled areas in substrate to provide an even plane.
- .2      New concrete should be cured for a minimum of 7 days and must be dry before waterproofing membranes are applied. Lightweight structural concrete must be cured a minimum of 14 days.

**3.6                PROTECTION OF IN-PLACE CONDITIONS**

- .1      Use warning signs and barriers. Maintain in good order until completion of Work.
- .2      Clean off drips and smears of bituminous material immediately.
- .3      At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

**3.7                PRIMER**

- .1      Apply primer for self-adhered membrane by roller or spray at rate recommended by manufacturer.
- .2      Allow minimum 30-minute open time. Primed surfaces not covered by waterproofing membrane during the same working day must be re-primed.

**3.8                JOINT AND CRACK TREATMENT**

- .1      All cracks in concrete 1.5 mm to 3 mm wide are to be pre-treated with a 1.5 mm (60 mil) coating of liquid membrane 50 mm wide centred on the crack. Alternately, apply a 150 mm wide strip of waterproofing membrane centred over crack. Provide 75 mm end laps.

- .2 Horizontal to vertical inside corner transition areas are to be pre-treated with a liquid membrane fillet extending 19 mm vertically and horizontally from the corner. Apply a minimum 225 mm strip of waterproofing membrane centred at the joint.
- .3 All outside corners are to be pre-treated with a minimum 225 mm strip of waterproofing membrane centred at the joint.
- .4 Where three or more planes come into contact reinforce with cut sections of waterproofing membrane reinforcing sheet as per manufacturer's instructions.

### **3.9 PROJECTIONS**

- .1 Extend water proofing membrane tight to projection and seal with liquid membrane extending 65 mm along projection and 65 mm onto the waterproofing membrane.

### **3.10 SELF-ADHESIVE WATERPROOFING MEMBRANE INSTALLATION**

- .1 Select waterproofing membrane according to temperatures during application. For membrane applications at temperature below -10 °C, contact membrane manufacturer.
- .2 Apply pre-stripped membrane and seal with waterproofing mastic to all protrusions through waterproofing membrane.
- .3 Align the first roll of membrane to a previously drawn chalk line.
- .4 Pre-strip edges with a 150 mm wide strip of membrane centered on the corner. Membrane to be installed in direct contact with the substrate not leaving any voids under the membrane strip.
- .5 Install membrane onto primed surface by peeling back the paper backing on the underside and adhering the membrane to the surface.
- .6 Install subsequent rolls in the same manner and aligned with the preceding roll with a side lap of at least 75 mm. End laps must be overlapped at least 150 mm.
- .7 Holes and tears in the membrane must be repaired with the appropriate membrane material. The repair must exceed the affected surface area by at least 75 mm. The membrane piece applied for the repair must be sealed around its edges with mastic.
- .8 Use a roller approved by manufacturer to apply pressure over the entire surface of the membrane to ensure perfect adhesion.
- .9 Contractor to verify meticulously the membrane installation at the end of each day of work and before application of membrane protection system and backfilling.
- .10 Seal all inside corner overlaps with a bead of mastic after membrane installation.
- .11 Uppermost edge of membrane is to be mechanically fastened to the concrete substrate using applicable fasteners and termination bars.
- .12 Apply mastic on the top edge of membrane to prevent water infiltration.
- .13 Any waterproofing membrane left exposed after backfilling shall be protected from ultra violet and mechanical damages.

### **3.11 PROTECTION BOARD, AND BOARD INSULATION**

- .1 Apply adhesive with spots 75 mm in diameter, every 300 mm. Bottom panel should be supported or mechanically fixed. On the top row of insulation, apply a continuous bead of

adhesive 25 mm wide to the top leading edge of the panels to be glued. This bead will protect the adhesive spots during initial cure by limiting the flow of moisture behind the insulation in case of rain.

- .2 When Extruded Polystyrene Board Insulation is Used:
  - .1 Apply adhesive with spots 75 mm in diameter, every 300 mm. Bottom panel should be supported or mechanically fixed. On the top row of insulation, apply a continuous bead of adhesive 25 mm wide to the top leading edge of the panels to be glued. This bead will protect the adhesive spots during initial cure by limiting the flow of moisture behind the insulation in case of rain.

### **3.12 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management. 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 & Waste Management. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with local regulations.
- .4 Remove bituminous markings from finished surfaces.
- .5 In areas where finished surfaces are soiled caused by work of this Section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
- .6 Repair or replace defaced or disfigured finishes caused by work of this Section.
- .7 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Place materials defined as hazardous or toxic in designated containers.
  - .2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
  - .3 Ensure emptied containers are sealed and stored safely.
  - .4 Unused adhesive, sealant, and asphalt materials must not be disposed of into sewer system, into streams, lakes, onto ground, or in other location where it will pose health or environmental hazard.
  - .5 Dispose of unused adhesive material at official hazardous material collections site approved by DCC Representative.
  - .6 Dispose of unused sealant material at official hazardous material collections site approved by DCC Representative.
  - .7 Dispose of unused asphalt material at official hazardous material collections site approved by DCC Representative.

### **3.13 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 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 ASTM C578-19 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - .2 ASTM C612-14, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
  - .3 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - .4 ASTM D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
  - .5 ASTM E84-21a Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .6 ASTM E96/E96M-21, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian Gas Association (CGA):
  - .1 CSA B149.3:20 - 2020, Code for the Field Approval of Fuel-Burning Appliances and Equipment.
- .3 Canadian General Standards Board (CGSB):
  - .1 CGSB 71-GP-24M-AMEND-77, Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .5 Underwriters Laboratories of Canada (ULC):
  - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  - .3 CAN/ULC-701.1:2017, Standard for Thermal Insulation, Polystyrene Boards.
  - .4 CAN/ULC-S702-14, Standard for Mineral Fibre Insulation for Buildings.
  - .5 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
  - .6 CAN/ULC S770-15, Standard Test Method for Determination of Long-term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

### **1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate work of other Subcontractors adjacent and penetrating board insulation which must be completed before or after insulation work.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's product literature, and data sheets for each type of board insulation. Include product characteristics, performance criteria, physical sizes, and limitations.
  - .2 Submit WHMIS SDS.
- .3 Shop Drawings: N/A.
- .4 Samples: When requested, submit sample 300 x 300 mm x full board thickness of each type of board insulation.
- .5 Certificates: When requested, submit manufacturer's product certificates certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .7 Manufacturer's Instructions: Submit manufacturer's installation instructions.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
  - .1 Deliver board insulation marked with its thermal resistance value, associated reference standard number, Type, and Class. Packaged in accordance with the associated reference standard.
- .2 Storage and Handling Requirements:
  - .1 Store materials in a clean, dry area and in accordance with manufacturer's recommendations.
  - .2 Store and protect plastic insulation from sunlight except as necessary during installation, protect from ignition sources, hydrocarbons, other petroleum derivatives, and other products that may cause degeneration.
- .3 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section.
- .4 Packaging Waste Management: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management

## **Part 2 Products**

### **2.1 INSULATION**

- .1 Extruded polystyrene (XPS): To CAN/ULC-701, for applications Under Floor Slab Insulation, horizontally:
  - .1 Type: 4.
  - .2 Compressive strength: Minimum 275 kPa.
  - .3 Board thickness: 100 mm As indicated on Drawings.

- .4 Size: Manufacturer's largest standard size.
- .5 Edges: square, taped and sealed, comes with Back face drainage grooves.
- .6 Thermal Resistance: RSI 0.88/25 mm to ASTM C518.
- .7 Water Absorption: ASTM C272: < 0.6% by Volume (96 hours water immersion).
- .8 Water Vapour Permeance: 1.0 Perms in accordance with ASTM E96.
- .9 Max Flame Spread rating: Class A.
- .10 Accessories: Vapour Barriers, Adhesives and Flashing Tape in alignment with Manufacturers requirements. As indicated on Drawings/Details.
- .2 Extruded polystyrene (XPS): To CAN/ULC-701, for insulation applications below grade - Concrete Faced Insulation Wall Panels, Vertically:
  - .1 Type: 3.
  - .2 Compressive strength: Minimum 140 kPa.
  - .3 Board thickness: 50 mm.
  - .4 Exterior concrete faced insulated wall panel sizes:
    - .1 Width: 610 mm.
    - .2 Length: 1,220 mm.
    - .3 Thickness: 100 mm.
  - .5 Edges: Ship Lapped.
  - .6 Thermal Resistance: RSI 0.88/25 mm to ASTM C518 (R 5.0/inch).
  - .7 Water Absorption: ASTM C272: < 0.7% by Volume (96 hours water immersion).
  - .8 Water Vapour Permeance: 0.8 Perms in accordance with ASTM E96.
  - .9 Max Flame Spread rating: Class A.
  - .10 Sustainable: Min. 20% recycled content, CFC and HCFC Free.
  - .11 Accessories: Vapour Barriers, Adhesives, clips & fasteners and Flashing Tape in alignment with Manufacturers requirements. As indicated on Drawings/Details. Provide Corner trims and profiles, include for all trims, closure pieces, caps, flashings, facias, soffits, and infills: brake formed to required profiles.
  - .12 Prefinished Surface:
    - .1 Concrete: Latex modified concrete mix, 8 mm (5/16") thick, with control joint score at mid-length.
    - .2 Edge Treatment: Tongue and groove along longitudinal foam edges, butt joints on lateral edges.
    - .3 Surface Finish: Textured Broom finish; Grey colour, may be coated.

## 2.2 ADHESIVE

- .1 Adhesive for Polystyrene: Synthetic rubber-based insulation adhesive compatible with polystyrene insulation, to CGSB 71-GP-24M.

## **2.3 ACCESSORIES**

- .1 Protection Board: Semi-rigid asphaltic fibre composition board, formed under heat and pressure or cement board, minimum 16 mm thick for below grade applications.
- .2 Perimeter Insulation Flashings: Coordinate supply of end closures and flashings for perimeter insulation system with Section 07 42 13.13 - Formed Metal Wall Panels.
- .3 Drainage board: high-strength drainage panel consisting of polypropylene core and fabric for installation over waterproof membranes with the following characteristics:
  - .1 Thickness: 10 mm as indicated on Drawings.
  - .2 Compressive strength: minimum 550 kPa.
  - .3 Flow rate: minimum 223 l/min/m.
- .4 Sheet steel: liner sheet, structural quality, grade A to ASTM A653, with Z275 zinc coating to ASTM A792.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed are clean, dry, smooth, and acceptable for application of board insulation in accordance with manufacturer's instructions:
  - .1 Inspect substrates in presence of DCC Representative.
  - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

### **3.2 INSTALLATION - PERIMETER FOUNDATION INSULATION**

- .1 Exterior application: extend boards as indicated on Drawings. Install on exterior face of perimeter foundation wall with adhesive.
- .2 Under slab application: Extend boards as indicated on Drawings covering full concrete slab area unless otherwise stated. Lay boards on level compacted fill.

### **3.3 INSTALLATION - UNDERSLAB INSULATION**

- .1 Extend boards as indicated on Drawings, and as follows:
  - .1 Lay boards on level compacted fill.
  - .2 Protect top surface of horizontal insulation from damage during concrete work by installing protection board.
- .2 Load Bearing Insulation: Install in accordance with manufacturer's instructions. Install board insulation horizontally having a minimum compressive strength of as per specifications to locations as indicated.
- .3 Tape joints of underslab insulation and fill with 0.9 kg (2 lb.) spray insulation.

**3.4 CLEANING**

- .1 Progress Cleaning: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management.

**3.5 PROTECTION**

- .1 Temporarily protect installed board insulation from inclement weather and sunlight.

**END OF SECTION**

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**Part 1        General**

**1.1            DEFINITIONS**

- .1 *Vapour Retarder*: Vapour Retarder materials and assemblies are intended to restrict the movement of water vapour due to vapour pressure differentials.
  - .1 Vapour Retarder and Vapour Barrier are used interchangeably in the drawings and specifications. This specification Section shall apply to both forms.
  - .2 Where combination Air Barriers and Vapour Retarders are identified, the membrane must act as both an air barrier and a vapour retarder.
  - .3 Where separate Air Barriers and Vapour Retarders are identified, a vapour retarder can act as a air barrier, but an air barrier must not act as a Vapour Retarder. Where a separate vapour permable Air Barrier is required see specification section for Air Barriers.
- .2 *Air Barrier*: Air Barrier materials and assemblies are intended to restrict the movement of air due to air pressure differentials.

**1.2            REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
  - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit one electronic copy of WHMIS SDS.
- .3 Certificates:
  - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.4            QUALITY ASSURANCE**

- .1 Mock-Ups:
  - .1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

- .2 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
- .3 Mock-up will be used to judge quality of work, substrate preparation, and material application.
- .4 Locate where directed.
- .5 DCC Representative will require minimum 24 hours to review the mock-up.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect specified materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 DESIGN CRITERIA**

- .1 Minimum Vapour Retarder Performance:
  - .1 The Vapour Retarder shall retard the passage of moisture as it diffuses through the assembly of materials of the Enclosure and shall meet or exceed the requirements of CAN/CGSB-51.34, Type 1.

### **2.2 SHEET VAPOUR BARRIER**

- .1 Underslab Plastic Sheet Vapour Retarder: High density, puncture resistant polyolefin resin sheet in accordance with ASTM E1745 and CAN/CGSB-51.34, and as follows:
  - .1 Location: Concrete Floors, on warm side of insulation.
  - .2 Thickness: 0.38 mm.
  - .3 Vapour Permeance: Nominal = < 0.044 Perms maximum.
  - .4 Tensile Strength and Puncture Resistance: ASTM E1745 Class A minimum.
  - .5 Accessories:
    - .1 Provide manufacturer's required seam tape (100 mm wide at seams and 50 mm wide elsewhere), pipe boots and vapour proofing mastic as



required to ensure continuity of vapour retarder performance and forming a complete system in accordance with CAN/CSA A23.1 and ASTM E1643.

**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 vapour retarder installation in accordance with manufacturer's written instructions:
  - .1 Visually inspect substrate in presence of DCC Representative.
  - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

**3.2 INSTALLATION: UNDERSLAB SHEET VAPOUR BARRIER**

- .1 Install vapour barrier in accordance with manufacturer's written instructions and ASTM E1643, and generally as follows:
  - .1 Unroll vapour barrier with the longest dimension parallel to direction of concrete placement.
  - .2 Lap vapour barrier onto face of grade beams.
  - .3 Overlap joints in accordance with manufacturer's requirements.
  - .4 Seal penetrations including pipe and conduit risers in accordance with manufacturer's written instructions.
  - .5 Make no additional penetrations except as required for placing of reinforcing steel and permanent utilities.
- .2 Repair damaged areas by cutting patches of vapour barrier membrane; sized to overlap damaged area, and tape all sides using manufacturer's required tape.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 Final Cleaning: remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management upon completion:
  - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .3 Waste Management: perform in accordance with Section 01 74 00 - Cleaning & Waste Management.

**END OF SECTION**

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**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Steel faced, polyurethane (polyisocyanurate) metal roof panels.
- .2    Accessories including fasteners and perimeter trim.

**1.2            REFERENCE STANDARDS**

- .1    Aluminum Association (AA):
  - .1    AA DAF 45-03, Designation System for Aluminum Finishes.
- .2    ASTM International (ASTM):
  - .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 A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .3    ASTM D523-14, Standard Test Method for Specular Gloss.
  - .4    ASTM D822/D822M-13, Standard Practice, For Conducting Test on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
  - .5    ASTM D2832-92, Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
  - .6    ASTM D1623: Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
  - .7    ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
  - .8    ASTM E72; Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
  - .9    ASTM E283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .10   ASTM E1592: Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
  - .11   ASTM E1646; Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
  - .12   ASTM E1680; Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
- .3    Canadian General Standards Board (CGSB):
  - .1    CAN/CGSB-93.1-M85, Sheet, Aluminum Alloy, Prefinished, Residential.
- .4    CSA Group (CSA):
  - .1    CAN/CSA S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members.

- .5 FM Global (FM):
  - .1 Approval Standard 4880; Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems.
  - .2 FM 4471; Approval Standard for Class 1 Panel Roofs.
- .6 UL Canada (ULC):
  - .1 CAN/ULC-S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials.
  - .2 CAN/ULC-S102: Standard Method of Test for Surface Building Characteristics of Building Materials and Assemblies.
  - .3 CAN/ULC-S126: Standard Method of Test for Fire Spread Under Roof Deck Assemblies.
  - .4 CAN/ULC-S134: Fire Test of Exterior Wall Assemblies.
  - .5 CAN/ULC-S138: Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration.
- .7 National Fire Protection Agency (NFPA):
  - .1 NFPA 259: Standard Test Method for Potential Heat of Building Materials.
  - .2 NFPA 268: Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
  - .3 NFPA 285: Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- .8 Canadian Sheet Steel Building Institute (CSSBI):
  - .1 CSSBI 20M-2017, Standard for Sheet Steel Cladding for Architectural, Industrial and Commercial Building Applications.
  - .2 CSSBI S8-2018, Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by DCC Representative, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to insulated wall panel system, installation of any separate air/water barriers, treatment of openings, and other requirements specific to the project.

### **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 building panels, hardware, and accessories and include product characteristics, performance criteria, physical size, finish, and limitations.

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- .2 Submit WHMIS SDS. Indicate VOC's for materials as follows:
    - .1 Indicate VOC's for material as follows:
      - .1 Sealant materials during application and curing.
      - .2 Finishing materials.
      - .3 Insulation adhesives.
      - .4 Paints.
      - .5 Isolation coatings.
  - .3 Shop Drawings:
    - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
    - .2 Indicate on drawings:
      - .1 Dimensions, wall openings, head, jamb, sill and mullion detail, materials and finish, anchor details, compliance with design criteria, and requirements of related work.
      - .2 Provide elevation drawings and building sections which show panels in relationship to required locations for structural support. Include panel details and details showing attachment to structural support.
      - .3 Profile.
      - .4 Gauge of both exterior and interior sheet.
      - .5 Location, layout, and dimensions of panels.
      - .6 Location and type of fasteners.
      - .7 Shape and method of attachment of all trim.
      - .8 Locations and type of sealants.
      - .9 Installation sequence.
      - .10 Other details as may be required for a weathertight installation.
  - .4 Panel analysis:
    - .1 Provide panel calculations to verify panels will withstand the design wind loads indicated and required by the National Building Code of Canada 2020 without detrimental effects or deflection  $L/240$  (roof). Include effects of thermal differential between the exterior and interior panel facings and resistance to fastener pullout.
  - .5 Samples:
    - .1 Submit duplicate 75 x 125 mm samples of wall system, representative of materials, finishes, and colours.
  - .6 Manufacturer's Site Reports:
    - .1 Submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in Part 3 - SITE QUALITY CONTROL.

## **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 composite metal building panels for incorporation into manual.

## **1.6 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Contractor to retain Third-party tester to test compliance of the roof assembly:
  - .1 Test Reports: Third-party Tester to provide certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions:
  - .1 Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.
  - .3 Store and protect metal building panels, hardware, and accessories from nicks, scratches, and blemishes.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **1.8 WARRANTY**

- .1 Limited Warranty:
  - .1 Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance including bond integrity, deflection and buckling:
    - .1 Warranty Period: Two (2) years from date of Substantial Completion.

- .2 Finish Warranty:
  - .1 Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess, and /or color fading:
    - .1 Warranty Period: Twenty (20) years from date of Substantial Completion.

## **Part 2 Products**

### **2.1 PERFORMANCE/DESIGN REQUIREMENTS**

- .1 Design metal panel wall system in accordance with CSA S136.
- .2 Design insulated metal panel system to be a layer of insulation between two layers of metal panels. Designed insulated panels to be a combined air and vapor barrier system.
- .3 Design members to withstand dead load and wind loads calculated in accordance with the National Building Code of Canada (NBC) and applicable local regulations, to maximum allowable deflection of L/240 for roof.
- .4 Structural Test: Structural performance shall be verifiable by witnessed structural testing for simulated wind loads in accordance with ASTM E72 and/or ASTM E1592.
- .5 Water Penetration: There shall be no uncontrolled water penetration through the panel joints at a pressure differential of 0.57 kPa, when tested in accordance with ASTM E331.
- .6 Overall Thermal resistance: RSI 1.32 per 25 mm (R 7.1) for an overall required value of RSI 7.24 (R 42).
- .7 Dynamic Water Penetration: There shall be no uncontrolled water penetration through the panel assembly.
- .8 Design insulated panels to be a combined air and vapor barrier system.
- .9 Air Infiltration: Air infiltration through the panel shall not exceed 0.032 cfm/sf at 0.3 kPa air pressure differential when tested in accordance with ASTM E1680.
- .10 Hailstorm Rating for roof panels: Factory Mutual 1 SH hailstorm rating:
  - .1 Tests performed in accordance with ASTM E84.
- .11 Design wall system to accommodate specified erection tolerances of structure.
- .12 Fire Test Response Characteristics: Steel-faced panels with polyisocyanurate (ISO) core shall fully comply with the National Building Code regarding the use of Foam Plastic:
  - .1 CAN/ULC S102, S126, S138 UL Canada fire test standards; successfully passed.
  - .2 NFPA 259 Potential Heat Content; established for foam core.
  - .3 Exterior Fire Exposure Test: The roof panels shall be tested as a Class A material per ASTM E108.
- .13 Include air and vapor barriers at openings and junctions to adjacent materials and assemblies to prevent infiltration and exfiltration of air and vapor through wall assembly.

- .14 Insulating core: 90 percent closed cell structure (per ASTM D6226) urethane modified isocyanurate core with the following minimum physical properties:
  - .1 Insulation Thermal resistance: RSI 1.32 per 25 mm (R 7.2) for an overall required value of RSI 4.17 (R 24).
  - .2 Foam has a density of 33.64 to 40.05 kg per cubic meter when tested in accordance with ASTM D1622.
  - .3 Shear Strength: 96.5 kPa per ASTM C273.
  - .4 Tensile strength : Panels shall have a compressive stress of 58.6 kPa. when tested according to ASTM D1623.
  - .5 Compressive Stress: Panels shall have a compressive stress of 96.5 kPa. when tested according to ASTM D1621.

## 2.2 MATERIALS

- .1 Insulated panel roofing assembly- non rated - installed long dimension on slope:
  - .1 Panel Thickness: minimum 150 mm, as required to meet indicated Thermal Resistance values:
    - .1 Thermal Resistance: minimum RSI 7.24 (R41).
  - .2 Panel Lengths: full length of roof from ridge to eave. Adjusted as required for openings.
  - .3 Panel width: 1,016 mm. Adjust at top of assembly for connection to roofing assembly. Adjust to meet roof dimensions.
  - .4 Panel Attachment: Shall consist of exposed fasteners and saddle washers.
- .2 Exterior Face of Panel:
  - .1 Material:
    - .1 AZ50/Galvalume/Zincalume per ASTM A792. Minimum Grade 33.
    - .2 Gauge: 24 gauge.
  - .2 Profile: High Rib: non-embossed with standing ribs spaced 508 mm on-center and lightly planked mesa intermediate ribs.
  - .3 Texture: Smooth, non-embossed.
  - .4 Exterior Paint Finish Color: Final color choice to be selected by DCC Representative from manufacturers entire color line (excluding premium and metallic colors).
  - .5 Exterior paint finish System:
    - .1 PVDF finish, dry film thickness of 1.0 mil including primer.
- .3 Interior Face of Panel:
  - .1 Material:
    - .1 AZ50/Galvalume/Zincalume per ASTM A792 minimum Grade 33.
    - .2 Gauge: 26 gauge.
  - .2 Profile: "Shallow" lightly planked mesa ribs on 56.3 mm (2.22") centers.

- .3 Texture: Non-directional stucco embossed.
- .4 Interior Paint Finish Color: Final color choice to be selected by DCC Representative from manufacturers entire color line (excluding premium and metallic colors).
- .5 Interior paint finish System:
  - .1 Modified polyester, dry film thickness of 1.0 mil including primer.

## 2.3 ACCESSORIES

- .1 System Accessories: ridge flashings, drip flashings, internal corner flashings, of same material, thickness, and finish as exterior cladding, and brake formed to shape.
- .2 Perimeter Trim and gutters:
  - .1 Perimeter trim, gutters, and penetration treatments: Fabricated perimeter trim, gutters, penetration treatments and metal flashing: Shall be same gauge, material, and coating color as exterior face of insulated metal roof panel:
    - .1 As per manufacturer recommendations.
  - .2 Downspouts and attachment clips to be of same materials and finishes as gutters:
    - .1 Downspouts to be minimum 100 mm x 100 mm.
    - .2 Supports to be installed maximum every 1,525 mm and at the top and bottom of each downspout.
- .3 Snow Guards:
  - .1 Snow Guard: 2 pipe steel tubular snow guards for metal roof.
  - .2 Fixing: Provide specific anchoring to suit roof profile.
  - .3 Guards: Twin steel Tubular guards between brackets (spaced in accordance with manufacturers requirements and recommendations).
- .4 Clips and Connectors: As recommended by manufacturer for complete installation of panels.
- .5 Fasteners:
  - .1 Structural fasteners: Self-drilling or self-tapping screws and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by factor-applied coating, with weather tight sealing washers.
  - .2 Saddle washer for panel attachment shall include integral self-sealing gasket supplied by the manufacturer.
  - .3 Stitch fasteners for roof panel sidelaps and endlaps shall be self-drilling low profile screws with sealing washers.
  - .4 Size and spacing: As recommended by manufacturer.
- .6 Sealant: as indicated in Section 07 92 00 - Joint Sealants and as recommended by manufacturer. Colour of exposed sealant to match adjacent panel:
  - .1 Butyl Sealants: Non-skinning/curing type as recommended by manufacturer.
- .7 Butyl Tape: As recommended by manufacturer.



- .8 Foam insulation for junctions and continuation of vapor barrier. 2-part urethane foam insulation compatible with the adjacent foam insulation. Insulation to be closed cell. As per manufacturer recommendations.
- .9 Fibrous Mineral Wool Insulation: Unfaced, preformed mineral slag fibrous insulation in accordance with CAN/ULC S702. Use and location as per manufacturers recommendation and as indicated on drawings.

### **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 composite metal building panel 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 approved by DCC Representative.
- .2 Provide field measurements to manufacturer as required to achieve proper fit of the preformed roof panel envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.
- .3 Wood trusses: The Contractor or installer shall examine the alignment of the trusses supports before installing the metal roof panel system:
  - .1 Structural Tolerance: In the plane of the roof  $\leq 5$  mm outward, 0 mm inward with a 3 mm maximum change in deviation for any member of any 3,050 mm run of panel.
- .4 The face of all structural members to which the panels are attached must be in the same vertical plane, flat and free of obstructions, such as weld marks, bolts, or rivet heads. In no case shall roof panels be fastened directly to structural framing members installed in the same direction of the roof panels.
- .5 Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

#### **3.2 INSTALLATION**

- .1 Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
- .2 Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.
- .3 Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions.
- .4 Butyl Weather Barrier Sealant:
  - .1 Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels.

- .2 Use non-skinning butyl tube sealant only for tight metal-to-metal contact.
- .3 Do not use non-skinning butyl tube sealant to bridge gaps.
- .5 At roof panels endlap apply butyl sealing tape to panel surface to be lapped per manufacturer's instructions.
- .6 Perform thermal clips as recommended by manufacturer.

### **3.3 SEALANT INSTALLATION FOR EXPOSED JOINTS AT ROOF PANELS**

- .1 Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.
- .2 Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size, and type of backer rod, and compatibility of materials for adhesion.
- .3 Direct contact between butyl and silicone sealants shall not be permitted.

### **3.4 TRIM INSTALLATION**

- .1 Place trim and trim fasteners only as indicated per details on the approved shop drawings.
- .2 Place a continuous strip of butyl tube sealant between the inside back face of closure trims and interior panel faces of panels for proper vapor seal.
- .3 Fasten the exterior ridge trim at roof panels to the metal ridge closure trims, per manufacturer's recommendations, with 6.4 mm by 22.23 mm stitch fasteners.

### **3.5 SITE QUALITY CONTROL**

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation, application, protection, and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Manufacturer's site services: include manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Obtain reports within 3 days of review and submit.

### **3.6 CLEANING AND PROTECTION**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day:
    - .1 Clean after installation to remove construction and accumulated environmental dirt.
    - .2 Wash down exposed interior and exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths. Wipe interior surfaces clean as part of final clean-up.
    - .3 Remove excess sealant with recommended solvent.
  - .2 Remove protective film immediately after installation.
  - .3 Touch-up, repair, or replace metal panels and trim that have been damaged.

- .4 Clean finished surfaces as recommended by metal panel manufacturer.
- .5 Repair or replace any damaged or defective panels after determination of responsibility.
- .6 Final Cleaning: remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management at completion.
- .7 Waste Management: separate waste materials for recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

**END OF SECTION**

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**Part 1            General**

**1.1            SECTION INCLUDES**

- .1      Steel faced, polyurethane (polyisocyanurate) metal wall panels.
- .2      Accessories including fasteners and perimeter and openings flashing and trim.

**1.2            REFERENCE STANDARDS**

- .1      Aluminum Association (AA):
  - .1          AA DAF 45-03, Designation System for Aluminum Finishes.
- .2      ASTM International (ASTM):
  - .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 A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .3          ASTM D523-14, Standard Test Method for Specular Gloss.
  - .4          ASTM D822/D822M-13, Standard Practice, For Conducting Test on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
  - .5          ASTM D2832-92, Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
- .3      Canadian General Standards Board (CGSB):
  - .1          CAN/CGSB-93.1-M85, Sheet, Aluminum Alloy, Prefinished, Residential.
- .4      CSA Group (CSA):
  - .1          CAN/CSA S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
- .5      FM Global (FM):
  - .1          Approval Standard 4880; Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems.
  - .2          Approval Standard 4881; Class 1 Exterior Wall Systems.
- .6      UL Canada (ULC):
  - .1          CAN/ULC-S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials.
  - .2          CAN/ULC-S102: Standard Method of Test for Surface Building Characteristics of Building Materials and Assemblies.
  - .3          CAN/ULC-S127: Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Building Materials.
  - .4          CAN/ULC-S134: Fire Test of Exterior Wall Assemblies.

- .5 CAN/ULC-S138: Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration.
- .7 National Fire Protection Agency (NFPA):
  - .1 NFPA 259: Standard Test Method for Potential Heat of Building Materials.
  - .2 NFPA 268: Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
  - .3 NFPA 285: Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- .8 Canadian Sheet Steel Building Institute (CSSBI):
  - .1 CSSBI 20M-2017, Standard for Sheet Steel Cladding for Architectural, Industrial and Commercial Building Applications.
  - .2 CSSBI S8-2018, Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by DCC Representative, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to insulated wall panel system, installation of any separate air/water barriers, treatment of openings, and other requirements specific to the project.

### **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 building panels, hardware, and accessories and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit WHMIS SDS. Indicate VOCs for materials as follows:
    - .1 Indicate VOCs for material as follows:
      - .1 Sealant materials during application and curing.
      - .2 Finishing materials.
      - .3 Insulation adhesives.
      - .4 Paints.
      - .5 Isolation coatings.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.

- .2 Indicate on drawings:
  - .1 Dimensions, wall openings, head, jamb, sill and mullion detail, materials and finish, anchor details, compliance with design criteria and requirements of related work.
  - .2 Profile.
  - .3 Gauge of both exterior and interior sheet.
  - .4 Location, layout and dimensions of panels.
  - .5 Location and type of fasteners.
  - .6 Shape and method of attachment of all trim.
  - .7 Locations and type of sealants.
- .4 Panel analysis:
  - .1 Provide panel calculations to verify panels will withstand the design wind loads indicated and required by the National Building Code of Canada 2020 without detrimental effects or deflection exceeding  $L/180$ . Include effects of thermal differential between the exterior and interior panel facings and resistance to fastener pullout.
- .5 Samples:
  - .1 Submit duplicate 75 x 125 mm samples of wall system, representative of materials, finishes and colours.
- .6 Manufacturer's Site Reports:
  - .1 Submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in Part 3 - SITE QUALITY CONTROL.

## **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 composite metal building panels for incorporation into manual.

## **1.6 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Contractor to retain Third-Party tester to test compliance of the wall assembly:
  - .1 Test Reports: Third-Party Tester to provide certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials as follows:
  - .1 Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

- .2 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.
  - .3 Store and protect metal building panels, hardware and accessories from nicks, scratches, and blemishes.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **1.8 WARRANTY**

- .1 Limited Warranty:
  - .1 Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance including bond integrity, deflection, and buckling:
    - .1 Warranty Period: Two (2) years from date of Substantial Completion.
- .2 Finish Warranty:
  - .1 Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and/or color fading in excess of 5  $\Delta E$  Hunter units on panels when tested in accordance with ASTM D2244:
    - .1 Warranty Period: Twenty (20) years from date of Substantial Completion.

## **Part 2 Products**

### **2.1 PERFORMANCE/DESIGN REQUIREMENTS**

- .1 Design metal panel wall system in accordance with CSA S136.
- .2 Design insulated metal panel system to be a layer of insulation between two layers of metal panels. Designed insulated panels to be a combined air and vapor barrier system.
- .3 Design metal panel wall to allow for thermal movement of component materials caused by ambient temperature range of 60 °C without causing buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects.
- .4 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .5 Design members to withstand dead load and wind loads calculated in accordance with National Building Code of Canada (NBC) and applicable local regulations, to maximum allowable deflection of 1/180<sup>th</sup> of span.

- .6 Water Penetration: There shall be no uncontrolled water penetration through the panel joints at a pressure differential of 0.96 kPa, when tested in accordance with ASTM E331.
- .7 Overall Thermal resistance: RSI 1.34 per 25 mm (R 7.2) for an overall required value of RSI 4.17 (R 24).
- .8 Dynamic Water Penetration: There shall be no uncontrolled water penetration through the panel assembly.
- .9 Design insulated panels to be a combined air and vapor barrier system.
- .10 Autoclave Test: Panels shall exhibit no delamination or shrinkage/melting of the foam core from the metal skins after being subjected in an autoclave to a pressure of 13.8 kPa at a temperature of plus 103 °C for a period of 2 1/2 hours.
- .11 Humidity Test: Panels shall exhibit no delamination or metal interface corrosion when subjected to plus 60 °C temperature and 100 percent relative humidity for a total of 1,500 hours (62 days).
- .12 Air Infiltration: Air infiltration through the panel shall not exceed 0.01 cfm/sf at 0.3 kPa air pressure differential when tested in accordance with ASTM E283.
- .13 Design wall system to accommodate specified erection tolerances of structure.
- .14 Fire Test Response Characteristics: Steel-faced panels with polyisocyanurate (ISO) core shall fully comply with the National Building Code regarding the use of Foam Plastic:
  - .1 CAN/ULC S102 Flame spread and smoke developed indices:
    - .1 Flame Spread: 25 or less.
    - .2 Smoke Developed: 250 or less.
  - .2 NFPA 259 Potential Heat Content; established for foam core.
  - .3 NFPA 268 Ignitability of Exterior Wall Assemblies Using a Radiant Heat Source; successfully passed acceptance criteria.
  - .4 CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction Materials:
    - .1 Fire Endurance Test - 10 minutes: 75 mm or greater Panels remained in place without joint stitch fastening.
    - .2 Fire Endurance Test - 10 minutes: Less than 75 mm Panels remained in place with joint stitch fastening.
  - .5 ASTM D1929 Minimum Flash and Self Ignition; established for foam core.
  - .6 S101, S102, S127, S134, S138 UL Canada fire test standards; successfully passed.
- .15 Include air and vapor barriers at openings and junctions to adjacent materials and assemblies to prevent infiltration and exfiltration of air and vapor through wall assembly.
- .16 Insulating core: Polyisocyanurate (ISO) core, ASTM C591 Type IV, CFC and HCFC free, compliant with Montreal Protocol and Clean Air Act, with the following minimum physical properties:
  - .1 Core is 95 percent closed cell when tested in accordance with ASTM D6226.
  - .2 Insulation Thermal resistance: RSI 1.34 per 25 mm (R 7.2) for an overall required value of RSI 4.17 (R 24).



- .3 Foam has a density of 35.24 to 44.85 kg per cubic meter when tested in accordance with ASTM D1622.
- .4 Compressive Stress: Panels shall have a compressive stress of 131 kPa. when tested according to ASTM D1621.
- .5 Shear Stress: 172 kPa when tested in accordance with ASTM C273.
- .6 Tensile Stress: 159 kPa when tested in accordance with ASTM D1623.

## 2.2 FINISH CHARACTERISTICS

- .1 Paint finish shall have the following characteristics:
  - .1 Gloss:  $15 \pm 5$  measured at 60 degree angle tested in accordance with ASTM D523.
  - .2 Pencil Hardness: HB-H minimum tested in accordance with ASTM D3363.
  - .3 Flexibility, T-Bend: 1-2T bend with no adhesion loss when tested in accordance with ASTM D4145.
  - .4 Adhesion: No adhesion loss tested in accordance with ASTM D3359.
  - .5 Abrasion Resistance: Nominal 65 liters of falling sand to expose 4 mm diameter of metal substrate when tested in accordance with ASTM D968.
  - .6 Acid Pollutant Resistance: No effect when subjected to 30% sulfuric acid for 18 hours, or 10% muriatic acid for 15 minutes when tested in accordance with ASTM D1308.
  - .7 Salt Fog Resistance: Passes 1,000 hours, when tested in accordance with ASTM B117 (5 percent salt fog at 35 °C).
  - .8 Color Retention: Passes 5,000 hours when tested in accordance with ASTM G153 and G154.
  - .9 Humidity Resistance: Passes 1,500 hours at 100 percent relative humidity and 35 °C, with a test rating of 10 when tested in accordance with ASTM D2247, and D714.
  - .10 Color Tolerances: Maximum of 5ΔE Hunter units on panels when tested in accordance with ASTM D2244.
  - .11 Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A.

## 2.3 MATERIALS

- .1 Insulated panel cladding assembly- non rated - installed horizontally:
  - .1 Panel Thickness: minimum 100 mm as required to meet indicated Thermal Resistance values:
    - .1 Thermal Resistance: minimum RSI 4.17 (R24).
  - .2 Panel Lengths: full length of building. Adjusted as required for openings.
  - .3 Panel height: As indicated on drawings. Adjust at top of assembly for connection to roofing assembly.

- .4 Panel Attachment: Shall consist of fasteners and stainless steel attachment clip completely concealed within the panel side joint.
- .5 Vertical Joint Treatments (for horizontal panels):
  - .1 Surface mounted aluminum extrusion with reveal and Flush aluminum insert.
- .6 Horizontal Panel Joint Reveals: 9.5 mm.
- .2 Exterior Face of Panel:
  - .1 Material:
    - .1 Steel coil material shall be in accordance with ASTM A755: AZ50 Galvalume®/ Zinalume® (55% aluminum, 45% zinc) in accordance with ASTM A792.
    - .2 Gauge: 22 gauge.
  - .2 Profile: "Shadowline" Linear striations nominal 1.5 mm (0.0625 in) deep by 19 mm (3/4 in) wide at 75 mm (3 in on center).
  - .3 Texture: Non-directional stucco embossed.
  - .4 Exterior Paint Finish Color: Final color choice to be selected by DCC Representative from manufacturers entire color line (excluding premium and metallic colors).
  - .5 Exterior paint finish System:
    - .1 1.0 mil. Fluoropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) SOLID color coat.
- .3 Interior Face of Panel:
  - .1 Material:
    - .1 Steel coil material shall be in accordance with ASTM A755: AZ50 Galvalume®/ Zinalume® (55 percent aluminum, 45 percent zinc) in accordance with ASTM A792.
    - .2 Gauge: 26 gauge.
  - .2 Profile: "Shadowline" Linear striations nominal 1.5 mm (0.0625 inch) deep by 19 mm (3/4 inches) wide at 75 mm (3 inches on center).
  - .3 Texture: Non-directional stucco embossed.
  - .4 Interior Paint Finish Color: Final color choice to be selected by DCC Representative from manufacturers entire color line (excluding premium and metallic colors):
    - .1 Proposed color: Ascot White: SR:0.69 E:0.85 SRI:8.
  - .5 Interior paint finish System:
    - .1 Modified polyester, dry film thickness of 1.0 mil including primer.

## 2.4 INSULATION

- .1 Polyisocyanurate insulation: Polyisocyanurate (ISO) core.

## 2.5 COMPONENTS

- .1 Exterior corners: of same, material, and finish as adjacent cladding material and brake formed to required angle, concealed corner brace, hairline exposed joint, pop rivet connections with painted head to match cladding:
  - .1 Panels to be mitered at corners.
  - .2 Provide manufacture recommended inside and outside trim flashings for corner covers.

## 2.6 ACCESSORIES

- .1 System Accessories: cap flashings, drip flashings, internal corner flashings, copings and closures for head, jamb, sill and corners, of same material, thickness and finish as exterior cladding, brake formed to shape.
- .2 Perimeter Trim:
  - .1 Fabricated perimeter trim and metal flashing: Shall be same gauge, material and coating color as exterior face of insulated metal wall panel.
  - .2 Extruded perimeter trim: Shall be extruded aluminum 6063-T5 alloy with spray applied PVF coating in same color as exterior face of insulated metal wall panel.
- .3 Clips and Connectors: As recommended by manufacturer for complete installation of panels.
- .4 Fasteners:
  - .1 Self drilling fasteners shall be corrosion resistant plated steel with neoprene washer, as recommended by manufacturer.
  - .2 Material: Hex-head type with steel and neoprene washer and 12 gauge stainless steel clip supplied by the manufacturer.
  - .3 Size: As recommended by manufacturer.
  - .4 Exposed fasteners to match color of adjacent metal.
- .5 Sealant: as indicated in Section 07 92 00 - Joint Sealants and as recommended by manufacturer. Colour of exposed sealant to match adjacent panel:
  - .1 Sealants: Butyl, non-skinning/curing type as recommended by manufacturer.
- .6 Butyl Tape: As recommended by manufacturer.
- .7 Compressible Foam closure. Width and thickness as per manufacturer recommendations. Lengths to be continuous.
- .8 Foam insulation for junctions and continuation of vapor barrier. 2-part urethane foam insulation compatible with the adjacent foam insulation. Insulation to be closed cell. As per manufacturer recommendations.
- .9 Fibrous Mineral Wool Insulation: Unfaced, preformed mineral slag fibrous insulation in accordance with CAN/ULC S702. Use and location as per manufacturers recommendation and as indicated on drawings.

---

**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 composite metal building panel 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 approved by DCC Representative.
- .2      Provide field measurements to manufacturer as required to achieve proper fit of the preformed wall panel envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.
- .3      Supporting Steel: Support members shall be installed within the following tolerances:
  - .1      Plus or minus 3 mm (1/8 in) in 1,525 mm (5 ft) in any direction along plane of framing.
  - .2      Plus or minus 6 mm (1/4 in) cumulative in 6,000 mm (20 ft) in any direction along plane of framing.
  - .3      Plus or minus 12.7 mm (1/2 in) from framing plane on any elevation.
  - .4      Verify that bearing support has been provided behind vertical joints of horizontal panel systems and horizontal joints of vertical panel systems. Width of support shall be as recommended by manufacturer.
- .4      Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

**3.2                PREPARATION**

- .1      Protect metal surfaces in contact with concrete, masonry mortar, plaster, or other cementitious surface with isolation coating.

**3.3                INSTALLATION**

- .1      Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
- .2      Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.
- .3      Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions.
- .4      Butyl Weather Barrier Sealant:
  - .1      Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels.
  - .2      Use non-skinning butyl tube sealant only for tight metal-to-metal contact.
  - .3      Do not use non-skinning butyl tube sealant to bridge gaps.

- .5 Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

### **3.4 SEALANT INSTALLATION FOR EXPOSED JOINTS**

- .1 Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.
- .2 Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.
- .3 Direct contact between butyl and silicone sealants shall not be permitted.

### **3.5 TRIM INSTALLATION**

- .1 Place trim and trim fasteners only as indicated per details on the approved shop drawings.
- .2 Place a continuous strip of butyl tape or butyl sealant on closure trims for the length of the panel to be covered as indicated on shop drawings.

### **3.6 SITE QUALITY CONTROL**

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation, application, protection, and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Manufacturer's site services: include manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Obtain reports within 3 days of review and submit.

### **3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day:
    - .1 Clean after installation to remove construction and accumulated environmental dirt.
    - .2 Wash down exposed interior and exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths. Wipe interior surfaces clean as part of final clean-up.
    - .3 Remove excess sealant with recommended solvent.
- .2 Final Cleaning: remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management at completion.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

### **3.8 PROTECTION**

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

- .2 Repair damage to adjacent materials caused by composite metal building panel installation.

**END OF SECTION**

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**Part 1            General**

**1.1               REFERENCE STANDARDS**

- .1    ASTM International (ASTM):
  - .1        ASTM C1193-16, Standard Guide for Use of Joint Sealants.
  - .2        ASTM C1330-18, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
- .2    Canadian General Standards Board (CGSB) 1330:
  - .1        CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3    Department of Justice Canada (Jus):
  - .1        Canadian Environmental Protection Act, 1999 (2018) (CEPA).
- .4    General Services Administration (GSA) - Federal Specifications (FS):
  - .1        FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .5    Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1        Safety Data Sheets (SDS).
  - .2        Sealant, Waterproofing, and Restoration Institute (SWRI): Sealants: The Professionals' Guide 2013.
- .6    Transport Canada (TC):
  - .1        Transportation of Dangerous Goods Act, 1992 (2019 amended) (TDGA).
- .7    ULC Standards/ UL Canada (ULC):
  - .1        CAN/ULC 115-2018, Standard Method of Fire Tests of Firestop Systems.

**1.2               ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1        Submit manufacturer's product data for each type of primer, backer rod, and sealants and include product characteristics, performance criteria, available colours, compatibility warnings, compliance standards, and limitations.
  - .2        Manufacturer's product to describe:
    - .1            Caulking compound.
    - .2            Primers.
    - .3            Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  - .3        Submit 2 copies of WHMIS SDS in accordance with Section 01 35 43 - Environmental Protection and Section 01 70 12 - Safety Requirements.

- .3 Samples:
  - .1 Submit two samples of each type of joint sealant material and colour.
  - .2 Submit two cured samples of exposed sealants of each colour to match adjacent material.
- .4 Certificates: When requested by DCC Representative, submit manufacturer's product certificates indicating proposed sealant is appropriate for each application on this Project.
- .5 Manufacturer's Instructions:
  - .1 Submit instructions for each type of product.
  - .2 Include letter from manufacturer indicating acceptable use of sealant for all installation applications.

### **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 incorporation into manual.

### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Manufacturer: Obtain each type of joint sealant from a single manufacturer.
- .2 Compatibility: Ensure sealants are compatible with adjacent materials and are approved by manufacture for use with adjacent materials.
- .3 Mock-Ups:
  - .1 Construct mock up in accordance with this Section.
  - .2 Before performing sealant work do sample applications of each type of sealant for review.
  - .3 Site locations for sample applications shall be designated by DCC Representative.
- .4 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Health Canada.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, with manufacturer's label.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect joint sealants from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.



- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and recycling.

## **1.6 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 Health Canada.
- .2 Ventilate area of work as required by use of portable supply and exhaust fans.

## **1.7 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 more than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
  - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

## **1.8 WARRANTY**

- .1 Manufacturer's warranty: Provide manufacturer's standard warranty documentation.

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 Use of materials as received from manufacturer without additives. Use one manufacturer's product for each type specified. Where sealant applications cross or contact each other, ensure compatibility, maintenance of physical properties and performance characteristics, and continuity of seal.

### **2.2 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.

## **2.3 SEALANT MATERIALS**

- .1 In air handling units and supply air system, use sealants without strong odors, without toxic chemicals, and are mold resistant.
- .2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .3 Where sealants are qualified with primers use only these primers.
- .4 Provide primers in accordance with manufacturer recommendation.

## **2.4 SEALANT MATERIAL DESIGNATIONS**

- .1 Type S-3: Silicone Sealant; general construction and air-seal sealant:
  - .1 To ASTM C920; type S; grade NS; class 50; use NT, M, G, O, and A.
- .2 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, and O.
- .3 Color of Sealants: as selected from standard sealant color charts.

## **2.5 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 the recommendations of SWRI, Sealants: The Professionals' Guide.
- .2 Make sealant selections consistent with manufacturer's recommendations.
- .3 Use silicone general construction sealant Type S-3 and S-7 for all joints, interior and exterior, where no other specific sealant type specified.

## **2.6 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.
    - .5 Size: oversize 30 to 50%.

- .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/m<sup>3</sup> density, or neoprene foam backer, size as recommended by manufacturer.
- .3 Bond Breaker Tape:
  - .1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.
  - .2 Primer: Non-staining type as recommended by sealant manufacturer for application substrate materials.
- .2 Joint Cleaner: Provide a non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's recommendations
- .3 Primer: Provide in accordance with sealant manufacturer's recommendations.
- .4 Masking Tape: Non-absorbent type, non-staining, compatible with joint sealant and joint substrates.

## **2.7 COLOURS**

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

## **Part 3 Execution**

### **3.1 PROTECTION**

- .1 Protect installed work of other trades from staining, damage, or contamination.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

### **3.2 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 Ensure joints are suitable to accept and receive the sealants.
  - .4 Ensure surfaces are sound, dry and free from dirt, water, frost, loose scale, corrosion, bitumen, paints, and other contaminants that may adversely affect the performance of the sealing materials.
  - .5 Verify substrates are without contaminants capable of interfering with sealant adhesion. Remove contaminants where occurring.
  - .6 Examine joint sizes and conditions to establish acceptable depth to width ratio for installation of backup materials and application of sealants.
  - .7 Verify joint widths are within the limits recommended by joint sealant manufacturer for applications indicated.

- .8 Ensure joints and spaces which are to receive sealants are less than 10 mm deep; and not less than 6 mm wide; and not more than 19 mm wide.
- .9 Before any sealing work is commenced, test the materials for indications of staining or poor adhesion.
- .10 NO FINGER FINISHING OF SEALANT - TOOL ONLY FINISH.
- .11 Inform DCC Representative of unacceptable conditions immediately upon discovery.
- .12 Proceed with installation only after unacceptable conditions have been remedied.

### 3.3 SURFACE PREPARATION

- .1 Perform cleaning to the extent required to achieve acceptable joint surfaces and as approved by sealant manufacturer.
- .2 Clean bonding joint surfaces of harmful contaminants including dust, rust, oil grease, and other matter which may impair adhesion.
- .3 Do not apply sealants to joint substrates treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Protect adjacent finishes from damage.
- .5 Prepare surfaces in accordance with manufacturer's directions.
- .6 Cleaning Procedures:
  - .1 Metal:
    - .1 Blast cleaning: sandblast or iron shot blast surfaces requiring heavy cleaning down to bright metal. Remove loose matter by compressed air or commercial vacuum cleaner.
    - .2 Power tool cleaning: Clean surfaces by wire brush, impact tools, abrasive wheels or by buffing. Remove loose matter by compressed air or commercial vacuum cleaner.
    - .3 Solvent cleaning: Clean with solvent applied by spray or brush. Wipe with clean, dry wiping cloths. Remove paint with paint remover and wipe with solvent. Remove residue.
  - .2 Concrete, Marble, Stone, and Brick:
    - .1 Remove friable material with wire brush or by chipping, until surfaces are sound. Remove surface residue with a stiff brush, vacuum cleaner, or compressed air.
    - .2 Concrete surfaces shall be cured for at least 28 days. Acid etched joint surfaces to remove alkaline salts and neutralize acid with a solution of tri sodium phosphate, followed by rinsing with clean, cold water.
    - .3 Allow joints to dry thoroughly.
    - .4 Completely remove resinous products used, such as curing compounds and form release agents.

- .7 Do not exceed shelf life and pot life of materials, and installation times, as stated by the manufacturers.
- .8 Be familiar with the work life of the sealant to be used. Do not mix multiple component materials until required for use.
- .9 Thoroughly mix multiple component sealants, and bulk sealants when recommended by manufacturer, using a mechanical mixer capable of mixing at 80 - 100 rpm without mixing air into the material. Continue mixing until the material is a uniform color and free from streaks of unmixed material.
- .10 Mask areas adjacent to joints to be sealed. Prevent contamination of adjacent surfaces. Remove masking promptly after the joint sealing has been completed.
- .11 Ensure joint surfaces are dry and frost free.
- .12 Prepare surfaces in accordance with manufacturer's directions.

### 3.4 PRIMING

- .1 Mask adjacent surfaces prior to priming and sealing where necessary to prevent staining.
- .2 Apply primer with a brush that will permit joint surfaces to be primed. Perform priming immediately before installation of sealants, allowing minimal time between priming and sealing as recommended by the sealant manufacturer.
- .3 Prime joints to receive sealants as recommended by the sealant manufacturer to prevent staining, to assist the bond and to stabilize pouring surfaces:
  - .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.).

### 3.5 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.

### 3.6 MIXING

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

### 3.7 APPLICATION

- .1 Sealant: Application: Apply sealants to recommendations of ASTM C1193, and in accordance with manufacturer's instructions, and as follows:
  - .1 Prime joints to receive sealants as recommended by the sealant manufacturer to prevent staining, to assist the bond, and to stabilize pouring surfaces.
  - .2 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.
  - .3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .4 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.
  - .5 Apply sealant in a continuous beads.
  - .6 Sealants generally shall be of gun grade or knife grade non-sag consistency to suit the joint condition. Use gun nozzles of the proper sizes to suit the joints and the sealant material. Sealants for horizontal joints (other than overhead joints) shall be self-levelling type.
  - .7 Apply sealant using pressure operated guns with proper size nozzle.
  - .8 Fill voids and joints solid.
  - .9 Form sealant surface with a smooth full bead, without from ridges, wrinkles, sags, air pockets, and embedded impurities.
  - .10 Tool exposed surfaces before skinning begins to give slightly concave shape and to achieve airtight joints:
    - .1 The use of fingers to produce final finish is not permitted. Contractor to self-monitor and remove any uneven and finger-finished surfaces at no cost to contract.
  - .11 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.
  - .12 Seal at all locations where dissimilar material 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.

### 3.8 CLEANING

- .1 Immediately clean adjacent surfaces that have been soiled and leave work in a neat, clean condition. Remove excess materials and droppings using recommended cleaners and solvents.
- .2 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Clean adjacent surfaces immediately of excess primers and sealants.

- .2 Remove excess and droppings, using recommended cleaners as work progresses.
- .3 Remove masking tape after initial set of sealant.
- .4 Leave Work area clean at end of each day.
- .3 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management upon completion.
- .4 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management. Perform cleaning after installation to remove construction and accumulated environmental dirt.

### **3.9 REPAIR**

- .1 Cut out damaged sealant, repeat preparation, prime joints, and install new material as specified, and acceptable to the manufacturer.

### **3.10 PROTECTION**

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

### **3.11 FIELD ADHESION TESTING**

- .1 Field test joint sealant adhesion to substrates in the presence of DCC Representative as follows:
  - .1 Extent of Testing: test completed, and cured sealant joints as follows:
    - .1 Perform 1 test for each 300 m of joint thereafter or 1 test per each floor per elevation.
  - .2 Test Method: test joint sealants according to method A, Field-Applied Sealant Joint Hand Pull Tab, Appendix X1, ASTM C1193 or Method A, Tail Procedure, ASTM C1521:
    - .1 For joints with dissimilar substrates, verify adhesion to each substrate separately. Extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  - .3 Inspect tested joints and report on finding for the following requirements:
    - .1 Joint cavities filled and free of voids.
    - .2 Sealant dimensions and configurations comply with sealant manufacturer's data sheet and printed installation requirements.
    - .3 No adhesive or cohesive failure noted during pull tests per ASTM criteria. Include data on pull distance used to test each kind of product and joint substrate.
    - .4 Record tests results in a field-adhesion test log. Include dates when sealants were installed, name of worker responsible in each instance, test dates, test locations, whether joints were primed or not, adhesion results and percent elongations, sealant fill, sealant configuration, and dimensions.
    - .5 Repair sealant test locations by applying new sealants following approved preparation and application procedures.

- .4 Evaluation of Field Adhesion Test results:
  - .1 Sealants passing ASTM pull-tests and compliant with specifications will be considered satisfactory.
  - .2 Remove sealants that fail adhesion tests or do not meet specifications and apply in accordance with approved preparation and application requirements.
  - .3 Retest re-applied sealants until test results are satisfactory and sealant application is compliant.

### 3.12 SCHEDULES

- .1 General Provisions:
  - .1 Examine the Contract Drawings and determine entire extent of Work of this Section. Seal joints at terminations, perimeters, transitions, and penetrations.
  - .2 Where no specified type of sealant is shown or specified, choose one of the sealants specified in this Section appropriate for its location and conditions as recommended by the sealant manufacturer in accordance with its warranty provisions and datasheet.
  - .3 Make sealant selections consistent with manufacturer's recommendations.
- .2 Materials Schedule:
  - .1 Where no specified type of sealant is shown or specified, choose one of the sealants specified in this Section appropriate for its location as recommended by the sealant manufacturer in accordance with its warranty provisions and datasheet.
  - .2 Make sealant selections consistent with manufacturer's recommendations.
- .3 Exterior Sealant Schedule:
  - .1 The following list is provided for general guidance and is not intended to exhaust all of the locations where sealant is required. Refer to item 3.12.1 - General Provisions of this Section for general provisions.
  - .2 Exterior sealant work is part of the work of this Section. Install exterior sealant to:
    - .1 General: seal open joints in surfaces exposed to view and as required to make the building weather-tight and airtight.
    - .2 Exterior joints between dissimilar materials.
    - .3 Perimeters of exterior openings where frames meet exterior façade of building.
    - .4 Exterior intake and exhaust louvres. Provide space in sealant at bottom for drainage.
    - .5 Penetrations through exterior building elements.
    - .6 Where indicated on drawings.



- .4      Foam sealant installation: Compression when expanded in joint, shall be 25% or uncompressed thickness. Depth shall be in accordance with manufacturer's sizing table.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1 American National Standards Institute/Steel Door Institute (ANSI/SDI):
  - .1 ANSI/SDI A250.7- 1997, Nomenclature for Standard Steel Doors and Steel Frames.
  - .2 ANSI/SDI A250.11- 12, Recommended Erection Instructions for Steel Frames.
- .2 ASTM International (ASTM):
  - .1 ASTM A167- 99, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip (Withdrawn).
  - .2 ASTM A653/A653M- 18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3 ASTM A780/A780M- 20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  - .4 ASTM A879/A879M- 12, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
  - .5 ASTM A924/A924M- 20, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .3 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
  - .2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  - .3 CAN/CGSB 82.5-M88, Insulated Steel Doors.
- .4 CSA Group (CSA):
  - .1 CSA G40.20-13 (R2018)/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59- 18, Welded Steel Construction, Includes Errata (2020).
- .5 Canadian Steel Door Manufacturers Association (CSDMA):
  - .1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000.
  - .2 Recommended Specifications for Commercial Steel Doors and Frames, 2006.
  - .3 Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.
  - .4 Storage and Installation Guide, 2012.
- .6 Fenestration & Glazing Industry Alliance (FGIA) (formerly American Architectural Manufacturers Association (AAMA)):
  - .1 AAMA 812- 19, Voluntary Practice for Assessment of Frame Deflection When Using One Component Polyurethane Foams for Air-Sealing Rough Openings of Fenestration Installations

- .7 Steel Door Institute (SDI):
  - .1 SDI-108- 18, Recommended Selection and Usage Guide for Standard Steel Doors.
  - .2 SDI-111- 09, Recommended Details for Standard Steel Doors, Frames, Accessories and Related Components.
  - .3 SDI-122- 15, Installation Troubleshooting Guide for Standard Steel Doors and Frames.
- .8 Underwriters Laboratories (UL):
  - .1 UL 2985- 2015, Sustainability Standard for Thermal Insulation.
- .9 ULC Standards (ULC):
  - .1 CAN/ULC-S701.1: 2017, Standard for Thermal Insulation, Polystyrene Boards.
  - .2 CAN/ULC-S702- 14, Standard for Mineral Fibre Thermal Insulation for Buildings.
  - .3 CAN/ULC-S704- 11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

## **1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Coordinate primers for doors and frames with site-applied paint as indicated in Section 09 91 00.08 - Painting for Minor Works.
  - .2 Coordinate throat dimensions based on actual material used for wall and partition construction assemblies.

## **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's product data for each type of door and frame. Indicate door designation, type and model, product characteristics, core description, fabrication details, dimensions, fire-protection rating and sound transmission class rating, finishes, and limitations.
  - .2 Submit WHMIS Safety Data Sheet (SDS).
- .3 Shop Drawings:
  - .1 For each type of door, indicate material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware, fire-protection rating, sound transmission classification rating, and finishes.
  - .2 For each type of frame, indicate material, core metal thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire-protection rating, sound transmission classification rating, and finishes.
  - .3 Include a schedule identifying each unit with door marks and numbers matching numbering on Drawings and door schedule.

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Warranty Documentation: Submit manufacturer's material and fabrication warranty.

#### **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Manufacturer: A member in good standing of the Canadian Steel Door Manufacturers Association.
- .2 Manufacturer: Obtain doors and frames from a single manufacturer.
- .3 Mock-Ups:
  - .1 Provide site mock-up for work of this Section indicating methods and materials, and proposed procedures to achieve design intent in accordance with Section 01 45 00 - Quality Control, and to comply with the following requirements, using materials indicated for completed work:
    - .1 Build mock-ups in location and size as directed by DCC Representative.
    - .2 Obtain DCC Representative's acceptance of mock-ups before starting construction.
    - .3 Use mock-up throughout construction period as a standard of acceptance for work of this Section.
    - .4 Accepted mock-up may form part of Work.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements and CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging with manufacturer's labels:
  - .1 Provide temporary protection during delivery and site storage to prevent distortion, surface damage, and rust.
  - .2 After arrival on site, remove wet wrapping materials, inspect doors and frames for damage, and notify delivery company and supplier if damage is found.
  - .3 Minor damage may be repaired if refinished products match new work, and are acceptable to DCC Representative.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in a dry, well-ventilated indoor location, in a manner that prevents sagging, bowing, or twisting, and in accordance with manufacturer's recommendations, and CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
  - .2 Store with space between stacked doors to allow air circulation.
  - .3 Store and protect steel doors and frames from nicks, scratches, and distortion.

## **1.7 SITE CONDITIONS**

- .1 Site Measurements: Before fabrication, verify actual dimensions of openings by measuring on site, and indicate actual measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Dimensions: When site measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating doors and frames without site measurements. Coordinate site construction to ensure that actual site dimensions correspond to established dimensions.

## **1.8 WARRANTY**

- .1 Manufacturer's Warranty: Submit manufacturer's standard warranty.

## **Part 2 Products**

### **2.1 PERFORMANCE REQUIREMENTS**

- .1 Design exterior frame assembly to accommodate expansion and contraction when subjected to a minimum and maximum surface temperature of -35 °C to 35 °C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175<sup>th</sup> of span.

### **2.2 MATERIALS**

- .1 Exterior Doors and Frames and Interior High Humidity Areas: Metallic coated steel sheets in accordance with ASTM A924/A924M, coated to ASTM A653/A653M, Commercial Steel (CS), Type B, ZF180 galvanized, stretcher levelled standard of flatness where used for face sheets.
- .2 Metallic Coated Steel Sheet Thickness: Minimum thickness in accordance with CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products, Table 1 and Appendix 1 and SDI-111.
- .3 Reinforcement Channels: To CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653/653M, ZF75:
  - .1 Hardware Reinforcement:
    - .1 Mortise Hinge: Door: 3.51 mm; Frame: 3.51 mm.
    - .2 Mortise or Bored Lock: Door: 1.98 mm; Frame: 1.98 mm.
    - .3 Mortise or Bored Deadlock: Door: 1.98 mm; Frame: 1.98 mm.
    - .4 Flush or Surface Bolt Front: Door: 1.98 mm; Frame: 1.98 mm.
    - .5 Surface/Concealed Closer: Door: 2.74 mm; Frame: 2.74 mm.
    - .6 Strike Reinforcements: Door: 1.98 mm; Frame: 1.98 mm.
    - .7 Hold Open Arm: Door: 1.98 mm; Frame: 1.98 mm.
    - .8 Door Surface HW Reinforce: Door: 1.30 mm; Frame: 1.30 mm.
    - .9 Frame Surface HW Reinforce: Door: 2.74 mm; Frame: 2.74 mm.
  - .4 Composites: Balance of core materials used in conjunction with lead, in accordance with manufacturer's proprietary design.

## **2.3 DOOR CORE MATERIALS**

- .1 Fibreglass with Vertical Steel Stiffeners: To CAN/ULC-S702, semi-rigid type, density 24 kg/m<sup>3</sup>, face sheets laminated spot welded to each face sheet at 150 mm on centre.

## **2.4 ADHESIVES**

- .1 Polystyrene and Polyurethane Core Adhesive: Heat resistant, epoxy resin based, low viscosity, contact cement.

## **2.5 ACCESSORIES**

- .1 Touch-up Primer: To CAN/CGSB-1.181.
- .2 Isolation Coating: Alkali-resistant bituminous paint or Epoxy resin solution.
- .3 Exterior Top Caps: stainless steel channel inserts.
- .4 Frame Thermal Breaks: Rigid polyvinylchloride extrusion conforming to ASTM D4726.
- .5 Door Bottom Seal: refer to Section 08 71 00 - Door Hardware.
- .6 Metallic Paste Filler: To manufacturer's standard.
- .7 Signage: Refer to Section 08 71 00 - Door Hardware.
- .8 Site-Applied Sealant at Frame Perimeter: refer to Section 07 92 00 - Joint Sealants for interior and exterior application.
- .9 Floor Anchors and Channel Spreaders: 1.60 mm nominal tee anchors, 1.19 mm wall stud anchors, and provide anchors appropriate to site conditions, as follows:
  - .1 Exterior Locations: Hot-dipped, zinc-coated.
- .10 Exposed Fasteners: Type 316 unless otherwise stated stainless steel to ASTM A167.

## **2.6 FABRICATION - FRAMES**

- .1 Fabricate frames in accordance with CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior Frames: 1.6 mm welded and thermally broken type construction.
- .4 Protect mortised cut-outs with steel guard boxes.
- .5 Reinforce frames for surface-mounted hardware.
- .6 Manufacturer's nameplates on frames and screens are not permitted.
- .7 Conceal fastenings except where exposed fastenings are indicated.
- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Insulate exterior frame components with polyurethane insulation.

## **2.7 FRAME ANCHORAGE**

- .1 Provide concealed anchorage to floor and wall construction:
  - .1 Where frames terminate at finished floor, supply floor plates for anchorage to slab. Check depth of extension of finished floor to structural slab and provide jamb extension anchorage as required. Provide 50 mm minimum adjustment.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1,520 mm, and one additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in previously placed concrete, masonry, or structural steel a maximum 150 mm from top and bottom of each jamb and intermediate anchors at a maximum 660 mm on centre.

## **2.8 FABRICATION - FRAMES, SLIP-ON TYPE**

- .1 Ship slip-on type frames unassembled.
- .2 Provide frames in accordance with SDI-122 and manufacturer's instructions.
- .3 Provide slip-on frames with manufacturer's proprietary design of wall anchorage comprising single, adjustable tension type per jamb, and provision for a secure attachment of each jamb base to stud runners.

## **2.9 FABRICATION - DOORS, GENERAL**

- .1 Exterior Doors: Thermally Insulated core construction.
- .2 Face Sheet: minimum of 1.6 mm base steel sheet thickness.
- .3 Stiffened, insulated and sound deadened with polyurethane core laminated under pressure to each face sheet.
- .4 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams continuous welded, filled, and sanded flush with no visible seam.
- .5 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .6 Blank, reinforce, drill, and tap doors for mortised, templated hardware.
- .7 Factory-prepare 12.7 mm diameter holes and larger on-site at time of hardware installation, except for mounting and through-bolt holes.
- .8 Reinforce doors for surface-mounted hardware where required. Provide flush and stainless steel top caps to exterior doors.
- .9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .10 Manufacturer's nameplates on doors are not permitted. Nameplates on hinge edge are acceptable.

## **2.10 FABRICATION - DOORS, HONEYCOMB, AND INSULATED CORE**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with polyurethane core laminated under pressure to face sheets.

## **2.11 FABRICATION - DOORS AND REINFORCED STEEL**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel.
- .2 Reinforce doors with vertical stiffeners, securely welded to face sheets at a maximum 150 mm on centre.
- .3 Fill voids between stiffeners of exterior doors with fibreglass core.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION - FRAMES**

- .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 jamb spreaders.
  - .2 Provide temporary wood spreaders at third points of frame rebate height to maintain frame width until adjacent building-in work completed.
  - .3 Provide vertical support at centre of head for openings exceeding 1,200 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 rough opening with low pressure spray-applied polyurethane foam to AAMA 812.
- .6 Apply sealant at perimeter of frames between frame and adjacent material.
- .7 Maintain continuity of air barrier and vapour retarder by sealing membrane to frame.
- .8 Install door silencers.

### **3.3 DOOR INSTALLATION**

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Doors 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, and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

### **3.4 INSTALLATION - DOOR HARDWARE**

- .1 Install hardware in accordance with manufacturer's instructions and Section 08 71 00 - Door Hardware, using manufacturer's door hardware templates.

### **3.5 SITE QUALITY CONTROL**

- .1 Tolerances: Provide even margins between doors and jambs, and doors and finished floor and thresholds as follows:
  - .1 Hinge Side: 1.0 mm.
  - .2 Latch Side and Head: 1.5 mm.
  - .3 Finished floor, non-combustible sill and thresholds: Maximum 19 mm.
  - .4 Refer to Section 01 91 13 - General Commissioning (Cx) Requirements for commissioning requirements.

### **3.6 ADJUSTING**

- .1 Use primer to touch-up finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to uniform, smooth finish.
- .3 Repair damage to zinc coatings in accordance with ASTM A780/A780M.
- .4 Repair damage to adjacent materials caused by metal doors and frames installation.
- .5 Adjust operable parts for correct function.

### **3.7 CLEANING**

- .1 Progress Cleaning: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management, and as follows:
  - .1 Remove traces of primer, sealants, epoxy, and filler materials. Clean doors and frames.
  - .2 Clean glass and glazing materials with approved non-abrasive cleaner.
- .2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .3 Waste Management: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management.

### **3.8 PROTECTION**

- .1 Protect installed products and components from damage during construction. Install temporary protective covering to exposed components.
- .2 Protect thresholds, hardware, frames, doors, and glass from damage. Lock operative door bottom in up position.

**END OF SECTION**

**Part 1        General**

**1.1            REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI)/Builders Hardware Manufacturers Association (BHMA):
  - .1 ANSI/BHMA A156.1- 2000, Butts and Hinges.
  - .2 ANSI/BHMA A156.2- 2017, Bored and Preassembled Locks and Latches.
  - .3 ANSI/BHMA A156.4- 2019, Door Controls - Closers.
  - .4 ANSI/BHMA A156.5- 2020, Cylinders and Input Devices for Locks.
  - .5 ANSI/BHMA A156.6- 2015, Architectural Door Trim.
  - .6 ANSI/BHMA A156.8- 2015, Door Controls - Overhead Stops and Holders.
  - .7 ANSI/BHMA A156.13- 2017, Mortise Locks and Latches.
  - .8 ANSI/BHMA A156.15- 2015, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
  - .9 ANSI/BHMA A156.16- 2018, Auxiliary Hardware.
  - .10 ANSI/BHMA A156.18- 2020, Materials and Finishes.
  - .11 ANSI/BHMA A156.20- 2021, Strap and Tee Hinges and Hasps.
  - .12 ANSI/BHMA A156.21- 2019, Thresholds.
  - .13 ANSI/BHMA A156.22- 2021, Gasketing.
  - .14 ANSI/BHMA A156.28- 2018, Recommended Practices for Mechanical Keying Systems.
  - .15 ANSI/BHMA A156.29- 2017, Exit Locks, Exit Alarms, Alarms for Exit Devices.
  - .16 ANSI/BHMA A156.36- 2020, Auxiliary Locks.
- .2 Canadian Steel Door Manufacturers' Association (CSDMA):
  - .1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2009.
- .3 American National Standards Institute (ANSI)/Door Hardware Institute (DHI):
  - .1 ANSI/DHI A115, Steel Door Prep Standards.
  - .2 ANSI/DHI A115.IG, Installation Guide for Doors and Hardware.
- .4 Door and Hardware Institute (DHI):
  - .1 Sequence and Format for the Hardware Schedule, 2019.
- .5 National Fire Protection Association (NFPA).
- .6 Canadian Steel Door and Frame Manufacturers' Association (CSDMA):
  - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

## **1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Coordinate with shop drawings or other Sections. Confirm that adequate provisions are made for locating and installing door hardware in accordance with indicated requirements, and as follows:
  - .1 Coordinate layout and installation of recessed pivots and closers, and cast-in anchoring inserts into floor construction with Section 04 22 00 - Concrete Unit Masonry.

## **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's product data for each type of door hardware. Include product characteristics, performance criteria, profiles, dimensions, finishes, and limitations.
- .3 Shop Drawings: Submit shop drawings indicating details of electrified door hardware including the following:
  - .1 Detailed interface between electrified door hardware and fire alarm system.
  - .2 Detailed interface between electrified door hardware, fire alarm, and emergency call system.
  - .3 Theory of operation for electrified door hardware groups.
  - .4 Wiring diagrams for power, signal, and control systems. Identify manufacturer-installed wiring and site-installed wiring:
    - .1 System schematic.
    - .2 Point-to-point wiring diagram.
    - .3 Riser diagram.
    - .4 Elevation of each electrified door.
- .4 Source Quality Control Submittals: When requested, submit proof of door hardware schedule consultant's participation in Door and Hardware Institute<sup>r</sup> (DHI) Continuing Education Program.
- .5 Hardware List:
  - .1 Submit contract hardware list.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish, and other pertinent information.
- .6 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .7 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .8 Contract Door Hardware Schedule: Submit schedule prepared by or under the supervision of a qualified hardware consultant detailing fabrication and assembly of door hardware:
  - .1 Comply with DHI Sequence and Format for the Hardware Schedule.

- .2 Organize the door hardware schedule into door hardware groups indicating a complete description of every item required for each door (or opening).
- .3 Indicate hardware make, model, material, function, handing, size, fastening, and finish using codes in BHMA A156.18, and other pertinent information.
- .4 Include keying schedule describing how each locking device is keyed in accordance with ANSI/BHMA A156.28. Index each key type to a specific door number.
- .5 Indicate location of each door hardware set, cross-referencing door numbers indicated in the Contract Documents.
- .6 Include an explanation of abbreviations, symbols, and alphanumeric codes in contract hardware schedule, where applicable.
- .7 Include description of each electrified door hardware function, sequence of operation, and coordinating interface with other systems (e.g. fire alarm).
- .8 Include DHI certification stamp on contract door hardware schedule.
- .9 Test Reports: When requested, submit certified test reports showing a product's compliance to a specified referenced standard.
- .10 Manufacturer's Instructions: Submit manufacturer's installation instructions.

#### **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 door hardware and incorporate into manual.
- .3 Warranty Documentation: Submit manufacturer's material and fabrication warranty.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Stock Materials: Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals:
  - .1 Tools: Supply two sets of wrenches for door closers locksets and fire exit hardware.
  - .2 Tools: Supply 4 keys per locked door.

#### **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  - .2 Only products meeting ANSI/BHMA standards are acceptable. Items that are equal in design, function, and quality will be accepted upon approval of the DCC Representative.
  - .3 Only recognized contract hardware distributors will be considered for the work of this section. The distributor shall have on staff a qualified Architectural Hardware Consultant recognized by the Door and Hardware Institute or a person

with equivalent qualifications to assist installers and direct detailing, processing and delivery of material, and certify installation acceptance.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .3 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging and with manufacturer's labels.
- .4 Package hardware items, including fasteners, separately or in groups of related hardware. Protect prefinished surfaces with wrapping, strippable coating, or other protective packaging. Label each package with their contents and location in building.
- .5 Storage and Handling Requirements:
  - .1 Store materials off ground in a dry, well-ventilated indoor location, and in accordance with manufacturer's recommendations.
  - .2 Store and protect door hardware from scratches and other damages.
  - .3 Protect prefinished surfaces with wrapping/strippable coating.
  - .4 Replace defective or damaged materials with new.
- .6 Packaging Waste Management: remove for reuse by manufacturer or in accordance with Provincial regulations and Owner's requirements.

## **1.8 MAINTENANCE SERVICE**

- .1 Provide maintenance service for one year during warranty period to maintain all barrier free entrance automatic operators as follows:
  - .1 Qualified service personal approved by manufacturer of operators.
  - .2 Site inspection every three months with all necessary adjustment made during this visit. Separate warranty service calls, if required, will only qualify as an inspection if time of call is close to the three-month intervals.

## **Part 2 Products**

### **2.1 DOOR HARDWARE**

- .1 Use products from only one manufacturer for similar items.
- .2 Provide ULC labeled devices in fire protection rated enclosures.
- .3 Hardware must be installed with fasteners supplied by hardware manufacturer.
- .4 Only door locksets and latches listed on ANSI/BHMA Standards list are acceptable for use on this project, unless otherwise accepted by DCC Representative, during Tender.
- .5 Locks and Latches:
  - .1 Interconnected locks and latches: To ANSI/BHMA A156.12, series 5000 interconnected lock, grade 1, designed for function and keyed as stated in hardware schedule.

- .2 Lever Handles: Plain design, barrier free compliant with handle return to door face. designed with antimicrobial coating:
  - .1 Escutcheons: Stainless Steel (630); round 54 mm diameter.
- .3 Cylinder Collar (rose, escutcheon): Round, same finish as handles.
- .4 Normal strikes: Box type, lip projection not beyond jamb.
- .5 Cylinders: To key into keying system as directed by DCC Representative.
- .6 Lever handles: Plain design, barrier free compliant with handle return to door face.
  - .7 Finished to stainless steel.
- .6 Butts and hinges:
  - .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .7 Door Closers and Accessories:
  - .1 Door closers: to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1, finished to 630.
  - .2 Overhead stops: With offset brackets to provide clearance between door closer and door stops. Recessed in top of door.
  - .3 Door hold: Kick down door stop. Stainless steel, rubber foot.
  - .4 Door Silencer: Heavy Duty. Frame inserted
- .8 Weather-stripping:
  - .1 Exterior doors: Jamb and head: Extruded aluminum frame with closed cell neoprene insert, clear anodized finish, mechanically fastened.
- .9 Automatic Door bottom:
  - .1 Door bottom smoke seal: heavy duty, door seal of extruded aluminum frame and closed cell neoprene seal, recessed in door bottom, closed ends, automatic retract mechanism when door is open and adjustable.
- .10 Thresholds:
  - .1 Thermally broken aluminum, mill finish, plain nonslip surface. Barrier free compliant.
  - .2 Depth of door frame (minimum 102 mm) wide x full width of door opening.
- .11 Kickplate:
  - .1 All door except aluminum: Stainless Steel (630), rectangular, 200 mm (8") x width of door minus 50 mm (2"), centered on door.

## 2.2 SIGNAGE LANGUAGE

- .1 All signage is to be bilingual and tactile. English signage requirements are provided for information only. Contractor to provide all required signage in both French and English and in braille.

## **2.3 FASTENINGS**

- .1 Use only fasteners provided by the 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 Match exposed fastening devices to finish of hardware.
- .4 Where pull is positioned on one side of the door and push plate on the other side, supply fastening devices, and install to secure pull through the door from the reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

## **2.4 KEYING**

- .1 Doors, padlocks and cabinet locks to be grand master keyed. Prepare detailed keying schedule in conjunction with DCC Representative.
- .2 Provide keys in duplicates for every lock of the Work.
- .3 Provide 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Provide construction cores.
- .6 Provide permanent cores and deliver keys to DCC Representative.
- .7 All four spaces to have same keying.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Manufacturer's Instructions: Comply with manufacturer's recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Provide metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Provide manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames Modular Construction:
  - .1 Operating hardware shall be installed at a height between 900 and 1,100 mm above the finished floor (NBCC 3.8.3.6).
- .5 Where door stop comes into contact with door pull, 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.
- .7 Remove construction locks/cores when directed by DCC Representative:
  - .1 Install permanent cores and confirm locks operate correctly.



- .8 Closers shall be installed according to Manufactures templates and installation instructions. Outswing doors shall be on push side using top jamb or parallel arm installation.

### **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.
- .4 Where hardware is found defective, repair, replace, or correct as required by manufacturer instruction or inspection reports.

### **3.3 CLEANING**

- .1 Progress Cleaning: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management and as follows:
  - .1 Leave Work area clean at end of each day.
  - .2 Remove protective coatings and wrappings from hardware items.
  - .3 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
  - .4 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Provincial regulations and Owner's requirements:
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.4 DEMONSTRATION**

- .1 Keying set-up:
  - .1 Contractor to coordinate key identification with existing control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book, and key receipt cards as required.
  - .2 Turn over keys to DCC Representative in accordance with closeout required.
- .2 Maintenance Staff Briefing: Brief maintenance staff regarding the following:
  - .1 Proper care, cleaning, disinfecting, and general maintenance of hardware.
  - .2 Description, use, handling, and storage of keys.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

### **3.5 PROTECTION**

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

- .2 Whenever possible, manufacturer's protective covering shall not be removed until final project cleaning takes place. Material not protected by manufacture shall be covered or removed from door during painting or any other adjustments that can cause damage to hardware.
- .3 Repair damage to adjacent materials caused by door hardware installation.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM):
  - .1 ASTM C811-98 (2008) Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacing.
  - .2 ASTM D635-18 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
  - .3 ASTM D638-14 Standard Test Method for Tensile Properties of Plastics.
  - .4 ASTM D2240-05 (2010) Standard Test Method for Rubber Property-Durometer Hardness.
  - .5 ASTM D2794-93 (R2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
  - .6 ASTM D4060-19 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
  - .7 ASTM D4263-83 (2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
  - .8 ASTM D4541-09e1 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
  - .9 ASTM F1869-22 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
  - .10 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .2 Canadian Standards Association (CSA):
  - .1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

### **1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation meeting:
  - .1 Convene a pre-application meeting two (2) weeks before commencing the Work of this Section. Require attendance of parties directly affecting Work of this Section, including DCC Representative, Contractor, Applicator, Manufacturer's technical Representative, and other Subcontractors affected by the Work of this Section to review the following:
    - .1 Surface Preparation.
    - .2 Priming.
    - .3 Application.
    - .4 Curing and Protection.
    - .5 Coordination with other work.

### **1.3 ACTION AND INFORMATION SUBMITTALS**

- .1 Product Data: Submit manufacturer's Product data per Section 01 33 00 - Submittal Procedures indicating:
  - .1 Product data on characteristics, performance criteria, and limitations.
  - .2 Preparation, installation requirements and techniques, Product storage, and handling criteria.
- .2 Samples: Submit samples of each type of fluid-applied flooring mounted on 250 mm x 200 mm hardboard, per Section 01 33 00 - Submittal Procedures.
- .3 Pre-Installation Reports:
  - .1 Submit manufacturer's quality control pre-installation testing program. Include information on type and number of tests conducted, locations, results, and recommendations.
  - .2 Submit written acceptance of substrate and environmental conditions prior to installation Work of this Section.
- .4 Submit field quality control reports confirming that the minimum epoxy film thickness specified has been installed, to Section 01 45 00 - Quality Control:
  - .1 Submit material orders and delivery receipts confirming that the amount of material ordered and installed meets manufacturer's application rate recommendations.
- .5 Close-Out Submittals: Submit maintenance data for each Product for incorporation into Operations and Maintenance Manuals per Section 01 78 00 - Closeout Submittals.

### **1.4 QUALITY ASSURANCE**

- .1 Comply with the requirements of Section 01 45 00 - Quality Control.
- .2 Company specializing in performing the work of this Section, with experience of projects of a similar nature and value as this tender.
- .3 Manufacturer's representative shall visit Site prior to commencing application and verify, in writing, that conditions and substrates are acceptable for the application of the Work of this Section.
- .4 Manufacturer's representative shall visit Site during the application of the Work of this Section and verify, in writing, that application is in accordance with this specification and manufacturer's recommendations.
- .5 Manufacturer's representative shall visit Site upon completion of the Work of this Section and verify, in writing, that application has been completed in accordance with this specification and manufacturer's recommendations.
- .6 Pre-Installation Meetings: Arrange for manufacturer's representative to inspect and test substrates and to review installation procedures 48 hours in advance of installation.
- .7 Submit written inspection reports to Consultant and Construction Manager.

### **1.5 SITE CONDITIONS**

- .1 Provide mechanical ventilation for adequate airflow to remove accumulated VOCs until full cure (approximately seven days after last coat).

- .2 Maintain environmental controls so relative humidity kept below 70% (by hot air furnaces) and temperature maintained between 20 °C and 30 °C during application and curing.
- .3 Ambient and Substrate Temperature: maintained between 10 °C and 30 °C during application and curing.
- .4 Mixing and Application attempted at Material, Ambient and/or Substrate Temperature conditions less than 18 °C (65 °F) will result in a decrease in Product workability and slower cure rates.
- .5 Install temporary protection and facilities to maintain Product manufacturers, and above specified environmental requirements for periods of time required by manufacturer.
- .6 Erect suitable barriers and post legible signs at points of entry to prevent traffic and trades from entering the work area during application and curing period of the floor.

## **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 in clean, dry location indoors, off ground, and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area. Protect from extremes of heat and cold. Protect from freezing.
  - .2 Replace defective or damaged materials with new
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of padding, crates, packaging materials pallets, as specified in Waste Reduction and Workplan Construction Waste Management Plan.

## **Part 2 Products**

### **2.1 COATS**

- .1 Moisture Insensitive floor screed - 3 mm to 4 mm.
- .2 Moisture tolerant, epoxy resin-based primer and moisture barrier - 3 mm minimum.
- .3 Primer and finish coat - Chemically Resistant Resinous Flooring - 2 mm.
- .4 Epoxy cove.

### **2.2 PERFORMANCE CRITERIA**

- .1 Minimum required physical Properties: Chemically Resistant Resinous Flooring:
  - .1 Tensile Strength: 45 MPa (6,572 psi) in accordance with ASTM D638.
  - .2 Pull-off Strength: 2.7 MPa (392 psi) in accordance with ASTM D4541.
  - .3 Hardness: 85 Shore D in accordance with ASTM D2240.

- .4 VOC Content:  $\leq 5$  g/L in accordance with ASTM D2369.
- .5 Abrasion Resistance: 120 mg loss in accordance with ASTM D4060 (CS17/1,000 cycles/1,000 g).
- .2 Minimum required physical Properties: Epoxy Cove Mortar: three-component, solid colour, low odour, low VOC, vertical grade coving and detailing mortar with primer:
  - .1 Compressive Strength: 41 MPa (5,946 psi) at 28 days in accordance with ASTM D695.
  - .2 Tensile Strength: 36 MPa (5,221 psi) at 28 days in accordance with ASTM D638.
  - .3 Hardness: 83 Shore D in accordance with ASTM D2240.
  - .4 VOC Content:  $\leq 5$  g/L in accordance with ASTM D2369.
  - .5 Pull-off Strength:  $> 1.7$  MPa (246 psi) with 100% substrate failure in accordance with ASTM D4541.

## 2.3 MATERIALS

- .1 Floor Crack Filler: Provide filler Sealer paste that is recommended by Manufacturer of Epoxy flooring system to repair cracks, gaps, and imperfections found on the concrete substrate.
- .2 Resinous Flooring System: two components, solid colour, high solids, low odour, fast setting, self-priming, chemical resistance, smooth, glossy epoxy finish and as follows:
  - .1 Applied Thickness:
    - .1 Prime Coat: 203  $\mu\text{m}$  (8 mils) wet film thickness.
    - .2 Top Coat: 381  $\mu\text{m}$  (15 mils) wet film thickness.
  - .2 Location: All interior concrete surfaces (horizontal and vertical).
  - .3 Colour and Pattern: as selected by DCC Representative and/or Consultant from manufacturer's full range.

## 2.4 ACCESSORIES

- .1 Quartz Broadcast: manufacturer's recommended blended quartz.
- .2 Patching and Fill Material: as recommended by epoxy flooring manufacturer.
- .3 Flexible Joint Filler Material: as recommended by epoxy flooring manufacturer.
- .4 Moisture mitigation product: as recommended by epoxy flooring manufacturer.
- .5 Provide all cleaning agents, cleaning cloths, sanding materials, and clean-up materials required per manufacturer's specifications.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verify condition of previously installed Work upon which this Section depends. Report defects to DCC Representative. Commencement of Work means acceptance of existing conditions.

- .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

### 3.2 PREPARATION

- .1 General: Prepare and clean substrates according to epoxy flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for epoxy flooring application.
- .2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with epoxy flooring:
  - .1 Roughen concrete substrates as follows:
    - .1 Mechanically profile surfaces with an apparatus that abrades the concrete surface to a profile as specified by system application guide.
    - .2 Comply with ASTM C811 requirements unless manufacturer's written instructions are more stringent.
  - .2 Repair damaged and deteriorated concrete according to epoxy flooring manufacturer's written instructions.
  - .3 Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions:
    - .1 Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application of epoxy flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1,000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab area in 24 hours.
    - .2 Perform plastic sheet test, ASTM D4263. Proceed with application only after testing indicates absence of moisture in substrates:
      - .1 Perform relative humidity test using in situ probes, ASTM F2170.
      - .2 Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
      - .3 Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
    - .3 Epoxy Materials: Mix components and prepare materials according to epoxy flooring manufacturer's written instructions.
    - .4 Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
    - .5 Treat control joints and other non-moving substrate cracks to prevent cracks from reflecting through epoxy flooring according to manufacturer's written instructions.
- .3 Existing Epoxy Surfaces:
  - .1 Clear and Clean all existing epoxy flooring surfaces.

- .2 Sand epoxy flooring in accordance with manufacturers requirements and instructions in preparation to receive over coat(s) of new epoxy finish.

### 3.3 INSTALLATION

- .1 General: apply components of epoxy flooring system according to manufacturer's printed instructions to produce a uniform, monolithic wearing surface of thickness recommended by manufacturer:
  - .1 Coordinate application of components to provide optimum adhesion of epoxy flooring system to substrate, and optimum inter-coat adhesion.
  - .2 Cure epoxy flooring components according to manufacturer's written instructions.
  - .3 Prevent contamination during application and curing processes.
  - .4 At substrate expansion and isolation joints, comply with epoxy flooring manufacturer's printed instructions.
  - .5 Minimum thickness: As per the manufacturers described system thickness requirements.
- .2 Apply primer and base coats in thicknesses indicated for flooring system.
- .3 Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer. Integrate broadcast aggregate for standard system texture (to rejection if recommended by manufacturer for selected system), and backroll sealer to lock aggregate in place.
- .4 Integral Cove Base: apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and top-coating of cove base. Round internal and external corners.
- .5 Integral Cove Base: 100 mm high.

### 3.4 FIELD QUALITY CONTROL

- .1 Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 90 sq. m of epoxy flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring and correct deficiencies.
- .2 Material Sampling: Owner may at any time and any number of times during epoxy flooring application require material samples for testing for compliance with requirements.

### 3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management. Leave Work area clean at end of each day:
  - .1 Prevent overspray and/or splashes to adjacent surfaces.
  - .2 Clean spills, splashes, and/or or overspray immediately using manufacturer's recommended cleaners and procedures.



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

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction. Protect epoxy flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by epoxy flooring manufacturer.
- .2 Repair damage to adjacent materials caused by Work of this Section.

**END OF SECTION**

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**Part 1            General**

**1.1               REFERENCE STANDARDS**

- .1    Green Seal Environmental Standards (GS):
  - .1       GS-11-2008, 2nd Edition, Paints and Coatings.
- .2    Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1       Safety Data Sheets (SDS).
- .3    The Master Painters Institute (MPI):
  - .1       Architectural Painting Specification Manual - Current Edition.
  - .2       Maintenance Repainting Manual - Current Edition.
- .4    National Research Council Canada (NRC):
  - .1       National Building Code of Canada 2020 (NBC).

**1.2               ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1       Submit manufacturer's instructions, printed product literature, and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2       Submit 2 copies of WHMIS SDS in accordance with Section 01 35 43 - Environmental Protection and 01 70 12 - Safety Requirements.
- .3    Certificates:
  - .1       Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  - .2       Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No. 13.

**1.3               QUALIFICATIONS**

- .1    Maintain a current and valid ACS certification during project period:
  - .1       Application specialists who perform surface preparation and coating application work on this project must have a current ACS.
- .2    Notify DCC Representative of any change in application specialist certification status:
  - .1       Any delays to the completion of the Project due to invalid certifications will not be considered, and liquidated damages shall not be waived for any non-performance by Contractor.

**1.4               DELIVERY, STORAGE, AND HANDLING**

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

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Provide and maintain dry, temperature controlled, and secure storage.
  - .2 Store painting materials and supplies away from heat generating devices.
  - .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- .4 Fire Safety Requirements:
  - .1 Supply 1 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 (NFC) requirements.
- .5 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 00 - Cleaning & Waste Management.

## **1.5 SITE CONDITIONS**

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

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Supply paint materials for paint systems from single manufacturer.
- .2 Conform to latest MPI requirements for painting work including preparation and priming.
- .3 Materials in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual "Approved Product" listing:
  - .1 Use MPI listed materials having E2 E3 rating where indoor air quality requirements exist.

- .2 Primer: VOC limit 100 g/L maximum to GS-11.
- .3 Paint: VOC limit 100 g/L maximum to GS-11.
- .4 Colours:
  - .1 Submit proposed Colour Schedule to DCC Representative for review.
  - .2 Base colour schedule on selection of 1 base colour and 1 accent colour.
- .5 Mixing and tinting:
  - .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from DCC Representative for tinting of painting materials.
  - .2 Use and add thinner in accordance with paint manufacturer's recommendations:
    - .1 Do not use kerosene or similar organic solvents to thin water-based paints.
  - .3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.
  - .4 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.
- .6 Gloss/sheen ratings:
  - .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 Degrees	Sheen @ 85 Degrees
Gloss Level 1 - Matte Finish	Max. 5	Max. 10
Gloss Level 2 - Velvet	Max.10	10 to 35
Gloss Level 3 - Eggshell	10 to 25	10 to 35
Gloss Level 4 - Satin	20 to 35	Min. 35
Gloss Level 5 - Semi-Gloss	35 to 70	
Gloss Level 6 - Gloss	70 to 85	
Gloss Level 7 - High Gloss	More than 85	
  - .2 Gloss level ratings of painted surfaces as indicated.
- .7 Interior and Exterior painting:
  - .1 Concrete Masonry Units: smooth and split face block and brick:
    - .1 EXT 4.2A - Latex gloss level 3 finish.
  - .2 Galvanized Metal: high contact/high traffic areas (doors, frames, railings, and handrails, etc.):
    - .1 EXT 5.3B - Alkyd gloss level 3 finish.
- .8 Interior painting:
  - .1 Concrete horizontal surfaces: floors:
    - .1 INT 3.2B - Alkyd floor enamel gloss Level 1 finish.
  - .2 Concrete horizontal surfaces: ceiling in Phosphoric Acid Room:
    - .1 INT 3.2B - Alkyd floor enamel gloss Level 1 finish.

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**Part 3 Execution**

**3.1 GENERAL**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual except where specified otherwise.

**3.2 EXAMINATION**

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to DCC Representative damages, defects, unsatisfactory, or unfavourable conditions before proceeding with work.

**3.3 PREPARATION**

- .1 Protection of in-place conditions:
  - .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.
- .2 Surface Preparation:
  - .1 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of DCC Representative.
  - .2 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.
  - .3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil, and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
  - .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1,000 mm.
  - .5 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.
  - .6 Touch up of shop primers with primer as specified.

**3.4 APPLICATION**

- .1 Paint only after prepared surfaces have been accepted by DCC Representative.
- .2 Conform to manufacturer's application recommendations.

- .3 Use method of application approved by DCC Representative:
  - .1 Conform to manufacturer's application recommendations.
- .4 Apply coats of paint in continuous film of uniform thickness:
  - .1 Repaint thin spots or bare areas before next coat of paint is applied.
- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .6 Sand and dust between coats to remove visible defects.
- .7 Finish top, bottom, edges, and cutouts of doors after fitting as specified for door surfaces.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .4 Place paint, stains, and primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

**END OF SECTION**

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**Part 1            General**

**1.1               RELATED SECTIONS**

- .1       Section 03 30 00.09 - Cast-In-Place Concrete - Short Form

**1.2               REFERENCES**

- .1       ASTM International (ASTM):
  - .1       ASTM D638-10, Standard Test Method for Tensile Properties of Plastics.
  - .2       ASTM D648-18, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
  - .3       ASTM D790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .4       ASTM D2369-10e1, Standard Test Method for Volatile Content of Coatings.
  - .5       ASTM D2583-13, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
  - .6       ASTM D4060-19, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
  - .7       ASTM D4541-22, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
  - .8       ASTM D4541-09e1, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
  - .9       ASTM F2659-10(2015), Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter.
- .2       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.

**1.3               ADMINISTRATION REQUIREMENTS**

- .1       Pre-application Meeting:
  - .1       Convene a pre-application meeting two (2) weeks before commencing the Work of this Section. Require attendance of parties directly affecting Work of this Section, including DCC Representative, Contractor, Applicator, Manufacturer's technical representative, and other Subcontractors affected by the Work of this Section to review the following:
    - .1       Surface preparation.
    - .2       Priming.
    - .3       Application.
    - .4       Curing and protection.
    - .5       Coordination with other Work.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's Product data, including physical properties and appearance options including: standard colours, variable surface textures, and surface sheen.
  - .2 Submit WHMIS Safety Data Sheet (SDS).
- .3 Samples for Verification: Upon request, submit samples of each colour and material being applied, with texture to simulate actual conditions, on representative samples of the actual substrate and as follows for DCC Representative's verification:
  - .1 Use representative colours when preparing samples for review; resubmit until required sheen, colour, and texture are achieved.
  - .2 List of material and application for each coat of each sample; label each sample for location and application.
  - .3 Provide two (2) 100 mm square samples for each colour and finish.
  - .4 When Samples requested, obtain written acceptance of Samples in writing from the DCC Representative before commencing Work of this Section. Accepted Samples shall be the final standard of acceptance of the finish.
- .4 Operations and Maintenance Data: Submit manufacturer's printed maintenance instructions for repair, cleaning and maintenance procedures; include name of original installer and contact information.

#### **1.5 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications:
  - .1 Manufacturer shall be certified under ISO 9001. All liquid materials, including primers, resins, curing agents, finish coats, and sealants are manufactured and tested under an ISO 9001 registered quality system.
- .2 Applicator Qualifications:
  - .1 Applicators: Use experienced applicators having a record of successful in-service resinous flooring system applications similar in material and extent to those specified in this Section and as follows:
    - .1 Applicators must have completed flooring manufacturer's training program for Products specified.
    - .2 Applicators must be licensed, certified, or approved in writing by the flooring manufacturer for the Products specified.
- .3 Mock-Up:
  - .1 Upon request, construct one 10 sq.m. (100 sq.ft.) mock-up of each type and colour of resinous flooring in location acceptable to DCC Representative to demonstrate quality of finished system, complying with manufacturer's installation instructions and requirements of this Section and in accordance with Section 01 45 00 - Quality Control.



- .2 Arrange for DCC Representative's review and acceptance, obtain written acceptance before proceeding with Work.
- .3 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the Work of this Section. Mock-up shall be left in place for the duration of the Work.

## 1.6 SITE CONDITIONS

- .1 Do not install the Work of this Section outside of the following environmental ranges without Manufacturers' written acceptance:
  - .1 Material Temperature: Precondition material for at least 24 hours between 18 °C and 30 °C.
  - .2 Ambient and Substrate Temperature: Minimum/Maximum 10 °C/30 °C.
  - .3 Substrate temperature must be at least 3 °C above measured Dew Point.
  - .4 Mixing and Application attempted at Material, Ambient and/or Substrate Temperature conditions less than 18 °C will result in a decrease in Product workability and slower cure rates.
  - .5 Relative Ambient Humidity: maximum ambient humidity 85% (during application and curing).
  - .6 Measure and confirm acceptable test results for Ambient Relative Humidity, Ambient and Surface Temperature, and Dew Point.
- .2 Substrate Moisture:
  - .1 Moisture content of concrete substrate must be < 6% by mass as measured with an approved concrete moisture meter.
  - .2 Additionally, internal concrete relative humidity tests may be conducted as per ASTM F2170 and values must be ≤ 90%.
  - .3 If moisture content of concrete substrate is higher than 6% by mass and/or if relative humidity test results exceed readings of 90% RH, DCC Representative will instruct on addition of moisture mitigation systems or moisture tolerant primers.
- .3 Supply temporary utilities, including power, water, temporary ventilation and lighting for use by applicator.
- .4 Maintain constant ambient room temperature for 48 hours before, during and after installation or until cured. Minimum temperature of 10 °C and maximum temperature of 30 °C. Do not apply Product while ambient and substrate temperatures are rising.
- .5 Erect suitable barriers and post legible signs at points of entry to prevent traffic and trades from entering the work area during application and curing period of the floor.
- .6 Ensure adequate ventilation and air flow.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery:
  - .1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, batch or lot number, and date of manufacture.
  - .2 Material should be delivered to job site and checked for completeness and shipping damage prior to job start.
- .2 Storage:
  - .1 Store materials in accordance with manufacturer's written instructions.
  - .2 Keep containers sealed until ready for use. Material should be stored in a dry, enclosed, protected area from the elements.
  - .3 Do not subject material to excessive heat or freezing.
  - .4 Shelf life: Established based on manufacturer's written recommendation for each material being used.
- .3 Handling:
  - .1 Protect materials during handling and application to prevent damage or contamination.
  - .2 Condition materials for use accordingly to manufacturer's written instructions prior to application.
  - .3 Record material lot numbers and quantities delivered to jobsite/storage.

## **1.8 WARRANTY**

- .1 Submit Warranty information in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit Applicator's written warranty, signed and issued in the name of Owner warranting the Work of this Section against defects in materials and workmanship for a period of one (1) year from the date of Substantial Performance of the Work.

## **Part 2 Products**

### **2.1 PERFORMANCE CRITERIA**

- .1 System:
  - .1 Resinous Flooring System:
    - .1 Protective coating/surfacing/lining designed for use where chemical resistance is required on concrete or steel substrates.
    - .2 Solid colour, highly chemical resistant, high build, smooth, resin-rich, novolac vinyl ester floor coating system.
    - .3 Two-component epoxy primer that provides excellent adhesion to dry or damp concrete substrates.
    - .4 VOC Content:  $\leq 60$  g/L in accordance with ASTM D2369.
    - .5 System Thickness: minimum 1016  $\mu\text{m}$  (40 mils) w.f.t.
    - .6 Chemical Resistance: 75% phosphoric acid.

- .2 Primer:
  - .1 Compatible primer coat per Resinous Flooring System manufacturer's recommendations.
- .3 Aggregate:
  - .1 Compatible aggregate material per Resinous Flooring System manufacturer's recommendations.

## 2.2 MATERIALS

- .1 Primer:
  - .1 Two-component, clear, high solids, low odour, low VOC, moisture-tolerant epoxy primer and binder:
    - .1 Applied Thickness: 254  $\mu\text{m}$  (10 mils) w.f.t.
    - .2 Cold Temperature Cure: minimum 0 °C.
    - .3 Pull-off Strength: > 1.7 MPa (> 246 psi) in accordance with ASTM D4541.
    - .4 VOC Content:  $\leq 0$  g/L in accordance with ASTM D2369.
- .2 1st and 2nd Coats:
  - .1 Two-component, solid colour, highly chemical resistant, high build, smooth, resin-rich, novolac vinyl ester coating:
    - .1 Applied Thickness: 381  $\mu\text{m}$  (15 mils) w.f.t. per coat.
    - .2 Tensile Strength: 70 MPa (10,152 psi) in accordance with ASTM D638.
    - .3 Tensile Modulus: 3,520 MPa (510,533 psi) in accordance with ASTM D638.
    - .4 Elongation: 3% in accordance with ASTM D638.
    - .5 Flexural Strength: 124 MPa (17,985 psi) in accordance with ASTM D790.
    - .6 Flexural Modulus: 3,800 MPa (551,143 psi) in accordance with ASTM D790.
    - .7 Heat Distortion Temperature: 140 °C (284 °F) in accordance with ASTM D648.
    - .8 Barcol Hardness: 40 in accordance with ASTM D2583.
    - .9 Abrasion Resistance: 0.2 g in accordance with ASTM D4060. (CS17/1000 cycles/1000 g).
    - .10 Pull-off Strength: > 1.7 MPa (> 246 psi) in accordance with ASTM D4541.
    - .11 VOC Content:  $\leq 60$  g/L in accordance with ASTM D2369.
- .3 Top Coat:
  - .1 Two-component, clear, highly chemical resistant, high build, smooth, resin-rich, novolac vinyl ester coating:
    - .1 Applied Thickness: 381  $\mu\text{m}$  (15 mils) w.f.t.

- .2 Tensile Strength: 70 MPa (10,152 psi) in accordance with ASTM D638.
- .3 Tensile Modulus: 3,520 MPa (510,533 psi) in accordance with ASTM D638.
- .4 Elongation: 3% in accordance with ASTM D638.
- .5 Flexural Strength: 124 MPa (17,985 psi) in accordance with ASTM D790.
- .6 Flexural Modulus: 3,800 MPa (551,143 psi) in accordance with ASTM D790.
- .7 Heat Distortion Temperature: 140 °C (284 °F) in accordance with ASTM D648.
- .8 Barcol Hardness: 40 in accordance with ASTM D2583.
- .9 Tensile Strength: 20.4 MPa (2,960 psi) in accordance with
- .10 Abrasion Resistance: 0.2 g in accordance with ASTM D4060. (CS-17/1000 cycles/1000 g).
- .11 Pull-off Strength: > 1.7 MPa (> 246 psi) in accordance with ASTM D4541.
- .12 VOC Content: ≤ 60 g/L in accordance with ASTM D2369.
- .4 Epoxy Cover Mortar:
  - .1 Three-component, solid colour, low odour, low VOC, vertical grade coving and detailing mortar with primer:
    - .1 Compressive Strength: 41 MPa (5,946 psi) at 28 days in accordance with ASTM D695.
    - .2 Tensile Strength: 36 MPa (5,221 psi) at 28 days in accordance with ASTM D638.
    - .3 Hardness: 83 Shore D in accordance with ASTM D2240.
    - .4 VOC Content: ≤ 5 g/L in accordance with ASTM D2369.
    - .5 Pull-off Strength: > 1.7 MPa (246 psi) with 100% substrate failure in accordance with ASTM D4541.

## **2.3 ACCESSORIES**

- .1 Provide all cleaning agents, cleaning cloths, sanding materials, and clean-up materials required per manufacturer's specifications.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Examine surfaces to receive flooring system. Submit Notice in Writing to DCC Representative and Contractor if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected. Do not apply flooring system to substrate treatments for moisture, repair, or levelling not of the same manufacturer

- .2 Surface must be clean, sound, and dry.
- .3 Pre-Installation Testing:
  - .1 Substrate moisture:
    - .1 Measure and confirm acceptable conditions for Substrate Moisture Content, Ambient Relative Humidity, Ambient and Surface Temperature and Dew Point.
    - .2 Confirm and record above values at least once every 3 hours during installation or more frequently whenever conditions change (e.g. Ambient Temperature rise/fall, Relative Humidity increase/decrease, etc.).
  - .2 Concrete substrate to have a minimum compressive strength of 25 MPa at 28 days and a minimum of 1.5 MPa in tension at time of application.
- .4 Ensure concrete substrate conforms to the minimum requirements of the flooring manufacturer.
- .5 Do not apply flooring system to sand-cement setting beds. Remove sand-cement beds to structural concrete substrate. Re-level/slope as required to achieve grade and/or drainage in accordance with manufacturer's minimum requirements.
- .6 Do not apply flooring system to asphaltic or bitumen membranes, soft wood, aluminum, copper, or fiberglass reinforced polyester/vinyl ester composites.
- .7 Apply to glazed or vitrified brick and tile, structural wood, and steel only with manufacturer's written recommendation for proper surface preparation.

### 3.2 PREPARATION

- .1 Prepare surface to receive flooring systems in accordance with manufacturer's written instructions.
- .2 Remove dirt, oil, grease, wax, laitance, curing compounds, water-soluble concrete hardeners, and other surface contaminants.
- .3 Remove sealers, finishes, and paints.
- .4 All projections, rough spots, etc. should be removed and patched to achieve a level surface prior to the application.
- .5 Remove unsound concrete by appropriate mechanical means.
- .6 Concrete: Clean and prepare to achieve laitance-free and contaminant-free, open textured surface by shot blasting or equivalent mechanical means. Provide CSP level in accordance with ICRI Guideline No. 310-2R and manufacturer's written recommendation.
- .7 Chemical Surface Preparation: Chemical surface preparation (acid etching) is unacceptable and will void manufacturer's warranty.
- .8 Control Joints and Cracks: Repair and treat control joints and surface cracks utilizing manufacturer's standard materials and installation details.

### **3.3 APPLICATION**

- .1 Mix and apply material in accordance with manufacturer's written installation instructions and procedures. Apply to manufacturer's recommended coverage rates unless thicker coverage is specified in this Section.
- .2 Follow manufacturer's written recommendations on terminations and connections to walls, drains, doorways, columns, and floor-to-floor transitions.
- .3 Do not apply while ambient and substrate temperatures are rising.
- .4 Apply resinous flooring with care to ensure that no laps, voids, or other marks or irregularities are visible. Apply to achieve appearance of uniform colour, and texture; all within limitations of materials and areas concerned.
- .5 If requested, match colours and textures of DCC Representative's accepted samples.
- .6 Install cove base 100 mm high with 25 mm radius in accordance with manufacturer's written instructions. Install cove base with a minimum 3 mm thickness.
- .7 Install L type white alloy or zinc base bead top strips at tops of concrete curbs, straight and level.

### **3.4 CLEANING**

- .1 Dispose of all waste from resinous flooring system installation in accordance with environmental legislation applicable to the Place of the Work and requirements of all Authorities Having Jurisdiction.
- .2 Dispose of empty containers at an approved waste handling facility for recycling or disposal.

### **3.5 PROTECTION**

- .1 Protect finished floor from damage by subsequent trades.
- .2 Protect freshly applied Products from dampness, condensation, and water for at least seventy-two (72) hours.
- .3 Monitor air flow and changes in air flow. Protect against introduction of dust, debris, and particles, etc. that may result in surface imperfections and other defects.
- .4 Follow manufacturer's written recommendations with respect to cure, wait time, and return to service.

**END OF SECTION**

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**Part 1            General**

**1.1            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Shop Drawings:
  - .1    Submit manufacturer's instructions, printed product literature, and data sheets for all plumbing fixtures and equipment and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2    Indicate on drawings:
    - .1    Mounting arrangements.
    - .2    Operating and maintenance clearances.
  - .3    Shop drawings and product data accompanied by:
    - .1    Detailed drawings of bases, supports, and anchor bolts.
    - .2    Acoustical sound power data, where applicable.
    - .3    Points of operation on performance curves.
    - .4    Manufacturer to certify current model production.
    - .5    Certification of compliance to applicable codes.
  - .4    In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures, use MCAC "Shop Drawing Submittal Title Sheet". Identify Section and paragraph number.

**1.2            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 plumbing fixtures and equipment for incorporation into manual:
  - .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 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to DCC Representative for approval. Submission of individual data will not be accepted unless directed by DCC Representative.
  - .2 Make changes as required and re-submit as directed by DCC Representative.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 DCC Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems, and low voltage control wiring.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of testing, adjusting, and balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to DCC Representative for approval and make corrections as directed.



- .4 Perform testing, adjusting, and balancing for HVAC using as-built drawings.
- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease, and adapters to suit different types of grease and grease fittings.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect all plumbing fixtures and equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of all packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

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**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                SYSTEM CLEANING**

- .1      Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

**3.3                FIELD QUALITY CONTROL**

- .1      Manufacturer's Field Services:
  - .1      Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.4                DEMONSTRATION**

- .1      Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting, and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2      Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3      Instruction duration time requirements as specified in appropriate Sections.

**3.5                CLEANING**

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

**3.6                PROTECTION**

- .1      Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1    ASTM International (ASTM):
  - .1        ASTM A126-04 (2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2        ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2    American Water Works Association (AWWA):
  - .1        ANSI/AWWA C700-09, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
  - .2        ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.
  - .3        ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound Type.
- .3    CSA Group (CSA):
  - .1        CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
  - .2        CSA B79-08, 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-R2010, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
  - .2        PDI-WH201-R2010, Water Hammer Arresters Standard.

**1.2            ADMINISTRATIVE REQUIREMENTS**

- .1    Pre-installation Meetings:
  - .1        Convene pre-installation meeting 1 week prior to beginning work of this Section, with DCC Representative to:
    - .1            Verify project requirements.
    - .2            Review installation and substrate conditions.
    - .3            Co-ordination with other building construction subtrades.
    - .4            Review manufacturer's written installation instructions and warranty requirements.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for all plumbing fixtures and equipment and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Indicate on drawings to indicate materials, finishes, dimensions construction, and assembly details and accessories for following: all plumbing specialties and accessories.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Manufacturers' Field Reports: manufacturers' field reports specified.

### **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 plumbing specialties and accessories for incorporation into 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.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of all packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 FUNNEL FLOOR DRAINS (FFD-1)**

- .1 Floor Drains and Trench Drains: to CSA B79.

- .2 Type 3: combination funnel floor drain; cast iron body with integral seepage pan, side outlet, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

## **2.2 CLEANOUTS**

- .1 Cleanouts shall be full size for pipe sizes up to 100 mm and not less than 100 mm on larger sizes. Cleanouts in inside finished areas shall all be of the same shape either round or square.
- .2 Cleanouts passing through a waterproofed floor or a slab on grade subject to hydrostatic pressure shall possess a clamping collar which shall be clamped to the floor membrane or lead flashing.
- .3 Pipe manufacturer's cleanouts are acceptable for vertical installation at the base of soil and waste stacks or rainwater leaders only.
- .4 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing caulked lead seat or neoprene gasket.
- .5 Wall access: face or wall type, stainless steel square cover with flush head securing screws, beveled edge frame complete with anchoring lugs.
- .6 Floor access: rectangular cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs, and:
  - .1 Plugs: bolted bronze with neoprene gasket.
  - .2 Cover for unfinished concrete floors: cast iron square, gasket, and vandal-proof screws.

## **2.3 WATER HAMMER ARRESTORS**

- .1 Copper construction, bellows, or piston type: to PDI-WH201.

## **2.4 VACUUM BREAKERS**

- .1 Breakers: to CSA-B64 Series, vacuum breaker, and atmospheric hose connection types as shown:
  - .1 Hot or Cold Water Anti-Siphon Vacuum Breakers to prevent the reverse flow of polluted water from entering into the potable water supply due to back siphonage.
  - .2 Consists of brass body construction, chemical resistant silicone seat disc, and an atmospheric vent to prevent spilling.
  - .3 Full size orifice to assure pipe size capacity and maximum flow.

## **2.5 PRESSURE REGULATORS**

- .1 Capacity: as indicated:
  - .1 Inlet pressure: 1,034 kPa.
  - .2 Outlet pressure: 413 kPa.
- .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 BACKWATER VALVES**

- .1 PVC body with valve seat, flapper, and threaded cover.
- .2 Access:
  - .1 Surface access.

## **2.7 STRAINERS**

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, bronze body, screwed ends, with brass cap.

## **2.8 EMERGENCY SHOWER/EYE WASH (ES-1)**

- .1 Combination emergency shower and eyewash station:
  - .1 General: corrosion resistant, combination shower and eye/face wash unit suitable for quick drenching or flushing of the eyes and body for immediate emergency use.
  - .2 Construction:
    - .1 Highly visible yellow ABS shower head and eyewash bowl.
    - .2 Removable plastic shell, 4 sections.
    - .3 Shell sealed with flexible vinyl trim.
    - .4 Eye/face wash sprayhead assembly: polypropylene spray heads with integral flip-top dust covers, filters, and 12 LPM flow control orifices mounted on a PVC-coated brass head assembly.
    - .5 Eye/face wash valves: chrome-plated brass, 12 mm stay-open ball valve hand operated by stainless steel push handle.
    - .6 Showerhead: highly visible yellow impact-resistant plastic.
    - .7 Shower valves: 316 stainless steel, 25 mm stay-open ball valve operated by a stainless steel pull rod with triangular handle.
  - .3 Shower operation: pull rod with triangular handle.
  - .4 Eyes wash operation: push handle.
  - .5 Eye/face wash spray heads shall contain antimicrobial agent.
  - .6 Pipe and fittings: 50 mm IPS Schedule 80 PVC.
  - .7 Mounting: PVC floor flange.
  - .8 Tepid water inlet: 32 mm bottom/rear supply inlet connection.
  - .9 Showerhead flowrate: 75.7 L per minute.
  - .10 Accessories: anti-scald valve.
  - .11 Dimensions (W x D x H): 489 x 959 x 2,165 mm.

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**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                MANUFACTURER'S INSTRUCTIONS**

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

**3.3                INSTALLATION**

- .1      Install in accordance with the National Plumbing Code of Canada (NPC), Provincial codes, and local Authority Having Jurisdiction.
- .2      Install in accordance with manufacturer's instructions and as specified.

**3.4                CLEANOUTS**

- .1      Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2      Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3      Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

**3.5                WATER HAMMER ARRESTORS**

- .1      Install on branch supplies to fixtures or group of fixtures where indicated.

**3.6                STRAINERS**

- .1      Install with sufficient room to remove basket for maintenance.

**3.7                START-UP**

- .1      General:
  - .1      In accordance with Section 01 91 13 - General Commissioning Requirements - General Requirements, supplemented as specified herein.
- .2      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.
- .3 Provide continuous supervision during start-up.

### 3.8 TESTING AND ADJUSTING

- .1 General:
  - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning Requirements - General 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, and removability of strainer.
  - .5 Clean out baskets.
- .6 Vacuum breakers, backflow preventers, and backwater valves:
  - .1 Test tightness and accessibility for O&M of cover and of valve.
  - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers and 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.
- .10 Pressure regulators and PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, and pressure conditions.



- .11 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.
- .12 Water meters:
  - .1 Verify location and accessibility.
  - .2 Test metre reading accuracy.

### **3.9 CLOSEOUT ACTIVITIES**

- .1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, Reports, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, Training of O&M Personnel, supplemented as specified.

### **3.10 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.11 PROTECTION**

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

**END OF SECTION**

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**Part 1            General**

**1.1               SUMMARY**

- .1 Thermal insulation for plumbing piping and piping accessories.

**1.2               DEFINITIONS**

- .1 For the purposes of this Section:
  - .1 Concealed means insulated mechanical services in suspended ceilings, or in non-accessible chases, or in furred-in spaces.
  - .2 Exposed means not concealed.
  - .3 Jacketing is synonymous with insulation cladding and lagging.
  - .4 Mineral fibre is synonymous with glass fibre, rock wool, or slag wool.

**1.3               REFERENCE STANDARDS**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
  - .1 ANSI/ASHRAE/IES 90.1-2022, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International (ASTM):
  - .1 ASTM C335/C335M-23, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.
  - .2 ASTM C449/C449M-07 (2024), Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .3 ASTM C921-10 (2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - .4 ASTM C1729-21, Standard Specification for Aluminum Jacketing for Insulation.
- .3 Midwest Insulation Contractors Association (MICA):
  - .1 North American Commercial and Industrial Insulation Standards (NACIIS) Manual, 9<sup>th</sup> Edition.
- .4 ULC Standards (ULC):
  - .1 CAN/ULC-S102-19 (R2024), Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S702.1-21, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

**1.4               ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit a schedule with a list of insulation for each service location, insulation type, thickness, and jacketing type.

- .2 Submit manufacturer's product literature, specifications, and datasheets. Include product characteristics, performance criteria, and limitations.

## **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: Specialist in performing work of this Section with at least three years successful experience in this type and size of project, member of Thermal Insulation Association of Canada (TIAC).

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address, and ULC markings.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 DESCRIPTION**

- .1 Regulatory Requirements:
  - .1 Combustible piping materials, including adhesives in accordance with CAN/ULC-S102:
    - .1 Flame-spread rating: Maximum 25.
    - .2 Smoke developed classification: Maximum 50.

### **2.2 INSULATION**

- .1 Thermal conductivity ("k" factor) not to exceed specified values at 24 °C mean temperature when tested in accordance with ASTM C335/C335M.
- .2 Type A-1: Rigid moulded mineral fibre without factory-applied vapour retarder jacketing:
  - .1 Mineral fibre: To CAN/ULC-S702.1.
  - .2 Maximum "k" factor: To CAN/ULC-S702.1.
- .3 Type A-3: Rigid moulded mineral fibre with factory-applied vapour retarder jacketing:
  - .1 Mineral fibre: To CAN/ULC-S702.1.

- .2 Jacketing: To ASTM C921.
- .3 Maximum "k" factor: To CAN/ULC-S702.1.

## 2.3 JACKETING

- .1 Polyvinyl Chloride (PVC) Jacketing:
  - .1 One-piece moulded type and sheet, in accordance with ASTM C921, with pre-formed shapes as required.
  - .2 Colours: as selected by DCC Representative from manufacturer's standard colour range.
  - .3 Minimum service temperature: -20 °C.
  - .4 Maximum service temperature: 65 °C.
  - .5 Moisture vapour transmission: Maximum 0.02 perm.
  - .6 Thickness: 0.51 mm (20 mils).
  - .7 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape in matching colour.
  - .8 Covering adhesive: Compatible with insulation.
- .2 Aluminum Jacketing: To ASTM C1729:
  - .1 Thickness: Minimum 0.50 mm sheet. Thickness based on the outer diameter of the insulation in accordance with ASTM C1729.
  - .2 Finish: Smooth.
  - .3 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
  - .4 Fittings: Minimum 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
  - .5 Jacket banding and mechanical seals: Stainless steel, 19 mm wide, minimum 0.5 mm thick at 300 mm spacing.
  - .6 Jacketing elbows: Factory fabricated, same material as adjacent straight jacketing, 2-piece, smooth finish, Class A.

## 2.4 ACCESSORIES

- .1 Weatherproof Sealant for Jackets Installed Outdoors: In accordance with Section 07 92 00 - Joint Sealants.
- .2 Tape: Self-adhesive, aluminum, reinforced, minimum 50 mm wide.
- .3 Contact Adhesive: Quick setting type.
- .4 Canvas Adhesive: Washable.
- .5 Tie Wire: Stainless steel, minimum 1.5 mm diameter.
- .6 Bands: Stainless steel, 19 mm wide, minimum 0.5 mm thick.

- .7 Thermal Insulating and Finishing Cement: To ASTM C449, hydraulic setting type, on mineral wool.
- .8 Vapour Retarder Lap Adhesive: Water-based and fire retardant type, compatible with insulation.
- .9 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.
- .10 Outdoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Verify that pressure testing of piping systems and adjacent equipment is complete, witnessed, and certified.
- .2 Verify that surfaces are clean, dry, and free from foreign material.

#### **3.2 INSTALLATION**

- .1 Install to manufacturer's instructions and in accordance with MICA, NACIIS Manual.
- .2 Provide two layers of insulation with staggered joints when required nominal wall thickness exceeds 75 mm.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .4 Install piping insulation continuous through wall and ceiling openings and sleeves.
- .5 Supports and Hangers:
  - .1 Hangers and supports in accordance with Section 22 05 00 - Common Work Results for Plumbing.
  - .2 Install hangars and supports outside vapour retarder jacket.
  - .3 Apply high compressive strength insulation that is suitable for piping service at oversized saddles and shoes where insulation saddles have not been provided.

#### **3.3 INSTALLATION - REMOVABLE PRE-FABRICATED INSULATION AND ENCLOSURES**

- .1 At valves, flanges, and unions at equipment:
  - .1 Install components to permit periodic removal and replacement without damage to adjacent insulation.
  - .2 Install insulation, fastenings, and finishes that are compatible with piping system.

#### **3.4 PIPING INSULATION SCHEDULE**

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings, unless otherwise specified.
- .2 Type: A-1:
  - .1 Securements: Stainless steel wire at 300 mm on centre.
  - .2 Seals: Lap seal adhesive, lagging adhesive.

- .3 Type: A-3:
  - .1 Securements: Stainless steel wire at 300 mm on centre.
  - .2 Seals: Vapour retarder lap seal adhesive, vapour retarder lagging adhesive.
- .4 Provide insulation thickness as listed in the following table:
  - .1 Run-out: Branch piping to individual fixtures not exceeding 4,000 mm long.
  - .2 Do not insulate exposed run-outs to plumbing fixtures:

Application	Piping Insulation Type	Run-out	Pipe sizes (NPS) to 1	Pipe sizes (NPS) 1 1/4 to 2	Pipe sizes (NPS) 2 1/2 to 4	Pipe sizes (NPS) 5 to 6	Pipe sizes (NPS) 8 & over
Domestic Hot Water Supply or Recirc	A-1	25 mm	25 mm	25 mm	38 mm	38 mm	38 mm
Domestic Cold Water Supply	A-3	25 mm	25 mm	25 mm	25 mm	25 mm	25 mm
Rain Water Leader or Pipe	A-3	25 mm	25 mm	25 mm	25 mm	25 mm	25 mm

- .5 Finishes:
  - .1 Exposed indoors: PVC jacketing.
  - .2 Exposed in mechanical rooms: PVC jacketing.
  - .3 Concealed, indoors: No additional finish.
  - .4 Outdoors: Waterproof aluminum jacketing.
  - .5 Finish attachments: Stainless steel bands, at 300 mm on centre.
  - .6 Seals: Wing.

### 3.5 SITE QUALITY CONTROL

- .1 Non-Conforming Work: Replace insulation where there is damage to the vapour barrier and insulation is saturated with moisture.

### 3.6 CLEANING

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

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1 American Society of Mechanical Engineers International (ASME):
  - .1 ANSI/ASME B16.15-13, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18-12, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22-13, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24-11, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500, and 2500.
  - .5 ASME B16.26-13, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .6 ASME B31.9-14, Building Services Piping.
  - .7 ASME B36.19M-04, Stainless Steel Pipe.
- .2 ASTM International (ASTM):
  - .1 ASTM A182/A 182M-16, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
  - .2 ASTM A269-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .4 ASTM A312/A312M-16, Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - .5 ASTM A351/A351M-16, Castings, Austenitic, for Pressure Containing Parts.
  - .6 ASTM A403/A403M-16, Wrought Austenitic Stainless Steel Piping Fittings.
  - .7 ASTM A536-84(2014), Standard Specification for Ductile Iron Castings.
  - .8 ASTM B32-08(2014), Standard Specification for Solder Metal.
  - .9 ASTM B42-15a, Seamless Copper Tube, Standard Sizes.
  - .10 ASTM B88M-14, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA):
  - .1 ANSI/AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .2 ANSI/AWWA C151/A21.51-09, Ductile Iron Pipe, Centrifugally Cast, for Water.
- .4 CSA Group (CSA):
  - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

- .5 Department of Justice Canada (Jus):
  - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):
  - .1 MSS-SP-67-02a, Butterfly Valves.
  - .2 MSS-SP-70-06, Grey Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71-05, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC):
  - .1 National Plumbing Code of Canada (NPC) 2020.
- .9 Transport Canada (TC):
  - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).
- .10 ULC Standards (ULC):
  - .1 CAN/ULC S101-07, Fire Endurance Tests of Buildings Construction and Materials.
  - .2 CAN/ULC S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
  - .3 CAN/ULC S115-11, Standard Method of Fire Tests of Firestop.

## **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Provide manufacturer's product literature and datasheets for insulation and adhesives. Include product characteristics, performance criteria, physical sizes, finishes, 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 Packaging Waste Management: remove for reuse and return of all packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **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 Buried or embedded:
  - .1 Copper tube, soft annealed, type L: to ASTM B88M, in long lengths and with no buried joints.

## **2.2 FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: 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 NPS 2 and larger:
  - .1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 ½ and smaller:
  - .1 Wrought copper to ANSI/ASME B16.22; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1,380 kPa.

## **2.3 JOINTS**

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

## **2.4 GATE VALVES**

- .1 NPS 2 and under, screwed:
  - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.
- .2 NPS 2 1/2 and over, in mechanical rooms, flanged:
  - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim.
- .3 NPS 2 1/2 and over, other than mechanical rooms, flanged:
  - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

## **2.5 GLOBE VALVES**

- .1 NPS2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

- .2 Lockshield handles: as indicated.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.
  - .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, regrindable seat.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .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.

## **2.7 BALL VALVES**

- .1 NPS 2 and under, screwed:
  - .1 Class 150.
  - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle.

## **2.8 BUTTERFLY VALVES**

- .1 NPS 2-1/2 and over, grooved ends:
  - .1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.
  - .2 Operator:
    - .1 NPS 4 and under: lever handle.
    - .2 NPS 6 and over: gear operated.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with NPC.
- .2 Install pipe work in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .7 Valves:
  - .1 Isolate equipment, fixtures, and branches with ball valves.
  - .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

### **3.2 PRESSURE TESTS**

- .1 Test pressure: greater of 1.5 times maximum system operating pressure or 860 kPa.

### **3.3 FLUSHING AND CLEANING**

- .1 Flush entire system for 8 hours. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

### **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 and expansion compensators are installed properly.

### **3.5 DISINFECTION**

- .1 Flush out, disinfect and rinse system to requirements of Authority Having Jurisdiction and approval of DCC Representative.
- .2 Coordinate with Section 33 14 16 - Site Water Utility Distribution Piping.
- .3 Upon completion, provide laboratory test reports on water quality for DCC Representative approval.

### **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 Bring HWS storage tank up to design temperature slowly.
  - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
  - .5 Check control, limit, and 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 of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
  - .8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements, Report Forms and Schematics.
  - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

### 3.8 OPERATION REQUIREMENTS

- .1 Coordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

### **3.9 CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 ASTM D2235- 22, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
  - .2 ASTM D2564- 20, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 CSA Group (CSA):
  - .1 CAN/CSA-Series B1800- 21, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .4 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 Shop Drawings:
  - .1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Provide two copies WHMIS SDS - Safety Data Sheets.

### **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 and address.
- .3 Store at temperatures and conditions recommended by manufacturer.
- .4 Packaging Waste Management: remove for reuse and return of all packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 PIPING AND FITTINGS**

- .1 Sanitary piping less than 3" (75 mm) inside the building can be copper or PVC.
- .2 Sanitary/storm piping less than 3" (75 mm) below ground shall be ABS, glued.
- .3 Sanitary/storm piping 3" (75 mm) and greater below ground shall be PVC, mechanical joints (hub and ring gasket).

- .4 For buried and above ground PVC or ABS DWV piping to:
  - .1 CAN/CSA B1800.

## **2.2 JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

## **Part 3 Execution**

### **3.1 APPLICATION**

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

### **3.2 INSTALLATION**

- .1 In accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.
- .2 Install in accordance with the National Plumbing Code and manufacturer's recommendations.

### **3.3 TESTING**

- .1 Pressure test buried systems before backfilling.
- .2 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 cleanout rods can probe as far as the next cleanout, at least.
- .2 Ensure fixtures are properly anchored, connected to system, and effectively vented.
- .3 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

### **3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1 American National Standards Institute/CSA Group (ANSI/CSA):
  - .1 ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
  - .2 ANSI Z21.10.1A-2006/CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
  - .3 ANSI Z21.10.1b-2006/CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
  - .4 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.
- .2 CSA Group (CSA):
  - .1 CSA B51:19, Boiler, Pressure Vessel, and Pressure Piping Code.
  - .2 CSA B149.1-15, Natural Gas and Propane Installation Code.
  - .3 CSA B149.2-20, Propane Storage and Handling Code.
  - .4 CSA C22.2 No.110-19, Construction and Test of Electric Storage Tank Water Heaters.
  - .5 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
  - .6 CSA C309:M90, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.
- .3 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 Provide manufacturer's printed product literature and datasheets for domestic water heater and include product characteristics, performance criteria, physical size, finish, and limitations.



.2 Indicate:

- .1 Equipment, including connections, fittings, control assemblies, and ancillaries, identifying factory and site 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 and address.
- .3 Packaging Waste Management: remove for reuse and return of all packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 ELECTRIC TANK WATER HEATER**

- .1 Tanks shall be listed by Underwriters' Laboratories and approved to the NSF Standard 5 by UL. Tanks shall have 1,034 kPa (150 PSI) working pressure and be equipped with extruded high density anode. All internal surfaces of the heater(s) exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 760 °C to 871 °C (1,400 °F to 1,600 °F). Electric heating elements shall be low watt density. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch. All internal circuits shall be fused. The outer jacket shall be of baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panel and shall enclose the tank with foam insulation. Electrical junction box with heavy duty terminal block shall be provided. The drain valve shall be located in the front for ease of servicing. Heater tank shall have a three year limited warranty as outlined in the written warranty. Manufacturer shall supply ASME rated temperature and pressure relief valve. Fully illustrated instruction manual to be included. Meets standby loss requirements of NRCan and current edition of ASHRAE/IES 90.1.

### **2.2 THERMAL EXPANSION TANK**

- .1 Carbon steel expansion tank of welded construction, stainless steel connection, heavy duty butyl diaphragm, rigid polypropylene liner, NSF-61 listed for potable water systems.

## **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.

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**3.2            INSTALLATION**

- .1      Install in accordance with manufacturer's recommendations and Authority Having Jurisdiction.
- .2      Provide insulation between tank and supports.
- .3      Install natural gas fired domestic water heaters in accordance with CSA B149.1.
- .4      Install propane gas fired domestic water heaters in accordance with CSA B149.2.

**3.3            SITE QUALITY CONTROL**

- .1      Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.
- .2      Refer to Section 01 91 13 - General Commissioning (Cx) Requirements for commissioning requirements.

**3.4            CLEANING**

- .1      Clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1      Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .2      Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

**END OF SECTION**

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**Part 1            General**

**1.1            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Shop Drawings:
  - .1    Submit manufacturer's instructions, printed product literature, and data sheets for all Division 23 products and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2    Indicate on drawings:
    - .1    Mounting arrangements.
    - .2    Operating and maintenance clearances.
  - .3    Shop drawings and product data accompanied by:
    - .1    Detailed drawings of bases, supports, and anchor bolts.
    - .2    Acoustical sound power data, where applicable.
    - .3    Points of operation on performance curves.
    - .4    Manufacturer to certify current model production.
    - .5    Certification of compliance to applicable codes.

**1.2            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 Division 23 products for incorporation into manual:
  - .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.

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- .4 Performance data to include:
    - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
    - .2 Equipment performance verification test results.
    - .3 Special performance data as specified.
    - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .5 Approvals:
    - .1 Submit 2 copies of draft Operation and Maintenance Manual to DCC Representative for approval. Submission of individual data will not be accepted unless directed by DCC Representative.
    - .2 Make changes as required and re-submit as directed by DCC Representative.
  - .6 Additional data:
    - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
  - .7 Site records:
    - .1 DCC Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems, and low voltage control wiring.
    - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
    - .3 Use different colour waterproof ink for each service.
    - .4 Make available for reference purposes and inspection.
  - .8 As-built drawings:
    - .1 Prior to start of Testing, Adjusting, and Balancing for HVAC, finalize production of as-built drawings.
    - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
    - .3 Submit to DCC Representative for approval and make corrections as directed.
    - .4 Perform testing, adjusting, and balancing for HVAC using as-built drawings.
    - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
  - .9 Submit copies of as-built drawings for inclusion in final TAB report.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One head gasket set for each heat exchanger.
  - .4 One glass for each gauge glass.
  - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 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, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for all Division 23 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 and after receipt of written approval to proceed from DCC Representative.

### **3.2 PAINTING REPAIRS AND RESTORATION**

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

### **3.3 SYSTEM CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.5 DEMONSTRATION**

- .1 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting, and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Use Operation and Maintenance Manual, as-built drawings, and audio visual aids as part of instruction materials.

### **3.6 CLEANING**

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

### **3.7 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

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**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 CSA Group (CSA):
  - .1 CAN/CSA B139-19, Installation Code for Oil Burning Equipment.
- .3 National Research Council Canada (NRC):
  - .1 National Fire Code of Canada 2020 (NFC).

**1.2                DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 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, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

**Part 2            Products**

**2.1                MATERIAL**

- .1 Paint: zinc-rich to CAN/CGSB-1.181:
  - .1 Primers, Coatings, and Paints: in accordance with manufacturer's recommendations for surface conditions.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

**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 flexible connections, hoses, or other approved fittings when equipment mounted on vibration isolation and when piping subject to movement.

### **3.3 CLEARANCES**

- .1 Provide clearance around systems, equipment, and components for observation of operation, inspection, servicing, maintenance, and as recommended by manufacturer and applicable codes and standards.
- .2 Provide space for disassembly, removal of equipment, and components as recommended by manufacturer and/or as indicated without interrupting operation of other system, equipment, or components.

### **3.4 DRAINS**

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain:
  - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap, and chain.

### **3.5 AIR VENTS**

- .1 Install air vents at high points in piping systems and as required by equipment manufacturer.
- .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 Install pipework to requirements of applicable codes and standards.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.



- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main:
  - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts, and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, and conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale, and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
  - .1 Install in accessible locations.
  - .2 Remove interior parts before soldering.
  - .3 Install with stems above horizontal position unless indicated.
  - .4 Valves accessible for maintenance without removing adjacent piping.
  - .5 Use valves at branch take-offs for isolating purposes except where specified.
  - .6 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2,400 mm above floor in Mechanical Rooms.

### **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, and 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 the fire-resistance rating integrity of the fire separation.
  - .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 FIRESTOPPING**

- .1 Coordinate the installation of fire stopping around pipes, insulation, and adjacent fire separation as indicated.
- .2 Pipes subject to movement: conform to fire stop system design listing to ensure pipe movement without damaging fire stopping material or installation.
- .3 Insulated pipes: ensure integrity of insulation and vapour barriers.

### **3.11 FLUSHING OUT OF PIPING SYSTEMS**

- .1 Flush system in accordance with Section 23 08 16 - Cleaning and Start-up of HVAC Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning & Waste Management supplemented as specified in relevant mechanical Sections.
- .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 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 of time in relevant mechanical Sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

- .5 Conduct tests in presence of DCC Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. DCC Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by DCC Representative.

### **3.13 EXISTING SYSTEMS**

- .1 Connect into existing piping systems at times approved by DCC Representative.
- .2 Request written approval by DCC Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

### **3.14 CLEANING**

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

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1 American Society of Mechanical Engineers (ASME):
  - .1 ASME B31.1-22, Power Piping.
- .2 ASTM International (ASTM):
  - .1 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2 ASTM A563/A563M-21ae1, Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- .3 American National Standards Institute (ANSI)/Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS):
  - .1 MSS SP58-2018, 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).

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings for:
    - .1 Bases, hangers, and supports.
    - .2 Connections to equipment and structure.
    - .3 Structural assemblies.

**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 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

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**Part 2            Products**

**2.1                SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts, and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
  - .3 Ensure that supports, guides, and anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:

**2.2                GENERAL**

- .1 Fabricate hangers, supports, and sway braces in accordance with MSS SP58 and ANSI B31.1.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

**2.3                PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized after manufacture.
  - .2 Use electro-plating galvanizing process.
  - .3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
  - .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.
- .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.
  - .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 Shop and field-fabricated assemblies:
  - .1 Trapeze hanger assemblies: as indicated.
  - .2 Steel brackets: as indicated.
- .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 22 mm or 28 mm rod.
- .6 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel galvanized.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP58, 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 SP58.
- .9 U-bolts: carbon steel to MSS SP58 with 2 nuts at each end to ASTM A563:
  - .1 Finishes for steel pipework: galvanized.
  - .2 Finishes for copper, glass, brass, or aluminum pipework: epoxy coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP58.

## **2.4 RISER CLAMPS**

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

## **2.5 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP58, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
  - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP58.

## **2.6 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

## **2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

## **2.8 HOUSE-KEEPING PADS**

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00.09 - Cast-in-Place Concrete - Short Form.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 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.
- .3 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

### **3.3 HANGER SPACING**

- .1 Plumbing piping: to National Plumbing Code of Canada (NPC).
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1: every 1.8 m.
- .4 Copper piping: up to NPS 1: 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 300 mm of each elbow.
- .7 Support Spacing: Conform to the following table:

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	

- .8 Pipework greater than NPS 12: to MSS SP58.

### 3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### 3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

### 3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.



### **3.7 CLEANING**

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

**END OF SECTION**

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**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Heat tracing cables for pipes and tanks including controls and installation.

**1.2 REFERENCE STANDARDS**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations:
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures:
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions:
  - .1 DCC Representative will make available 1 copy of systems supplier's installation instructions.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling, and unloading:
  - .1 Deliver, store, and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

**Part 2 Products**

**2.1 PIPE/TANK TRACING HEATING CABLES**

- .1 Type D: self-limiting heating cable with copper ground wire, elastomeric primary and overall jackets. Heating capacity: 26 W/m; for use with 120 V power supply.

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**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 Type D heating cables in accordance with manufacturer's instructions. Distribute and fasten cable evenly on pipe using pipe strap or tape at maximum spacing 0.5 m. Ensure that heating cables do not touch or cross each other. Run only cold leads in conduit and ensure sensing bulb does not touch cable. Ground shield to building ground. Coordinate cable installation with insulation application. Loop additional cable at fittings, valves, and flanges.
- .2        Make power and control connections.

**3.3                FIELD QUALITY CONTROL**

- .1        Tests:
  - .1        Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2        Use 500 V Megger to test cables for continuity and insulation value and record readings before, during and after installation.
- .3        Where resistance of 50 megohms or less is measured, stop work and advise DCC Representative.

**3.4                CLEANING**

- .1        Proceed in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2        Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**

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**Part 1            General**

**1.1            SUMMARY**

- .1    Section Includes:
  - .1    Materials and requirements for the identification of piping systems, duct work, valves, and controllers, including the installation and location of identification systems.

**1.2            REFERENCE STANDARDS**

- .1    CSA Group (CSA):
  - .1    CSA B149.1-20, Natural Gas and Propane Installation Code.
- .2    Canadian General Standards Board (CGSB):
  - .1    CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3    National Fire Protection Association (NFPA):
  - .1    NFPA 13-2022, Standard for the Installation of Sprinkler Systems.
  - .2    NFPA 14-2019, Standard for the Installation of Standpipe and Hose Systems.

**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    Delivery and Acceptance Requirements:
  - .1    Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3    Storage and Handling Requirements:
  - .1    Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .5    Paint and Coating Disposal:
  - .1    Dispose of unused paint and coating material at official hazardous material collections site.
  - .2    Do not dispose of unused paint and coating material into sewer system, into streams, lakes, onto ground, or in locations where it will pose health or environmental hazard.

## Part 2 Products

### 2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
  - .1 Equipment: manufacturer's name, model, size, serial number, and capacity.
  - .2 Motor: voltage, Hz, phase, power factor, duty, and 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 #	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20
  - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: use size #5.
  - .2 Equipment in Mechanical Rooms: use size #9.
- .5 Identification for PSPC Preventive Maintenance Support System (PMSS):
  - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
  - .2 Equipment in Mechanical Room:
    - .1 Main identifier: size #9.
    - .2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.3 Equipment elsewhere: sizes as appropriate.

## 2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this Section.
- .3 Before starting work, obtain written approval of identification system from DCC Representative.

## 2.4 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, and arrows:
  - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 °C and intermittent temperature of 200 °C.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from DCC Representative.
  - .2 Colours for legends, arrows: to following table:

Background Colour	Legend and Arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background Colour Marking	Legend
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold water supply	Green	DOM. CWS
Sanitary	Green	SAN
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Chemical dosing acid	Yellow	ACID

**2.5 IDENTIFICATION DUCTWORK SYSTEMS**

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: black or coordinated with base colour to ensure strong contrast.

**2.6 VALVES AND 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, and location of tagged item.

**2.7 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, and sensors with system nameplates specified in this Section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

**2.8 LANGUAGE**

- .1 Identification in English.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.
- .3 Identify systems and equipment to conform to PSPC PMSS.

### **3.3 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.

### **3.4 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, and 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.

### **3.5 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 Number valves in each system consecutively.

### **3.6 CLEANING**

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



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**END OF SECTION**

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**Part 1 General**

**1.1 SUMMARY**

- .1 TAB is used throughout this Section to describe the process, methods, and requirements of testing, adjusting, and balancing for HVAC.
- .2 TAB means to test, adjust, and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this Section.

**1.2 QUALIFICATIONS OF TAB PERSONNEL**

- .1 Submit names of personnel to perform TAB to DCC Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  - .1 Associated Air Balance Council (AABC) National Standards for Total System Balance, 7<sup>th</sup> Edition.
  - .2 National Environmental Balancing Bureau (NEBB), Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 9<sup>th</sup> Edition - 2019.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing, 3<sup>rd</sup> Edition - 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 SMACNA), requirements and recommendations contained in these procedures and requirements are mandatory.

**1.3 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

#### **1.4 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of Authority Having Jurisdiction.

#### **1.5 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

#### **1.6 PRE-TAB REVIEW**

- .1 Review Contract Documents before project construction is started 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.

#### **1.7 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

#### **1.8 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by DCC Representative for verification of TAB reports.

#### **1.9 START OF TAB**

- .1 Notify DCC Representative days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, and other construction affecting TAB.
  - .2 Application of weatherstripping, sealing, and caulking.
  - .3 Pressure, leakage, and other tests specified elsewhere Division 23.
  - .4 Provisions for TAB installed and operational.

- .3 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 Duct systems clean.
    - .2 Ducts, air shafts, and ceiling plenums are airtight to within specified tolerances.
    - .3 Correct fan rotation.
    - .4 Coil fins combed and clean.
    - .5 Access doors, installed, and closed.
    - .6 Outlets installed and volume control dampers open.
  - .3 Liquid systems:
    - .1 Flushed, filled, and vented.
    - .2 Correct pump rotation.
    - .3 Strainers in place, and baskets clean.
    - .4 Isolating and balancing valves installed and open.
    - .5 Calibrated balancing valves installed at factory settings.
    - .6 Chemical treatment systems complete and operational.

#### **1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus or minus 10%.

#### **1.11 ACCURACY TOLERANCES**

- .1 Measured values accurate to within plus or minus 2% of actual values.

#### **1.12 INSTRUMENTS**

- .1 Prior to TAB, submit to 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.

#### **1.13 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
  - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.

#### **1.14 TAB REPORT**

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .3 Submit TAB Report for verification and approval, in PDF format.

#### **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 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

#### **1.17 COMPLETION OF TAB**

- .1 TAB considered complete when final TAB Report received and approved by DCC Representative.

#### **1.18 HVAC SYSTEMS**

- .1 Standard: TAB to most stringent of TAB standards of AABC, NEBB, or SMACNA.
- .2 Do TAB of systems, equipment, components, and controls specified in Division 22, 23, and 25
- .3 Qualifications: personnel performing TAB qualified to standards of AABC or NEBB.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, components, and controls:
  - .1 Air Systems: Air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, and noise.
  - .2 Liquid Systems: flow rate, pressure, pressure drop, and temperature.
  - .3 Motors: RPM, electrical power, voltage, noise, and vibration.
- .6 Locations of equipment measurements: to include as appropriate:
  - .1 Air Systems: Inlet and outlet of dampers, filter, coil, humidifier, fan, and other equipment causing changes in conditions.

- .2 Liquid Systems: Inlet and outlet of pumps, heat exchangers, boilers, chillers, separators, terminal devices, coils, and other equipment causing changes in conditions.
- .3 At controllers and controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, and run-out (or grille, register, or diffuser).

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1               SUMMARY**

.1       Section Includes:

- .1       Thermal insulation for ductwork and ductwork accessories.

**1.2               DEFINITIONS**

.1       For purposes of this Section:

- .1       "Concealed" - means insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
- .2       "Exposed" - means "not concealed" as previously defined.
- .3       "Insulation systems" - means insulation material, fasteners, jackets, and other accessories.
- .4       "Jacketing" - synonymous with cladding and lagging.

**1.3               REFERENCE STANDARDS**

- .1       American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):
  - .1       ANSI/ASHRAE/IES 90.1-2022, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2       ASTM International (ASTM):
  - .1       ASTM C335/C335M-17, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.
  - .2       ASTM C449-07 (2019), Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .3       ASTM C553-13 (2019), Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .4       ASTM C612-14 (2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .5       ASTM C1729-21, Standard Specification for Aluminum Jacketing for Insulation.
  - .6       ASTM E2336-20, Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- .3       International Organization for Standardization (ISO):
  - .1       ISO 6944-1:2008, Fire Containment Elements of Building Construction, Part 1: Ventilation Ducts.
- .4       Midwest Insulation Contractors Association (MICA):
  - .1       North American Commercial and Industrial Insulation Standards (NACIIS) Manual, 9<sup>th</sup> Edition.
- .5       ULC Standards (ULC):
  - .1       CAN/ULC-S102-18, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

- .2 CAN/ULC-S702.1-21, Standard For Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit manufacturer's product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finishes, and limitations.

#### **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: Specialist in performing work of this Section, and have at least three years of successful experience in this type and size of Project, be qualified to standards of and a member of Thermal Insulation Association of Canada (TIAC).

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address, and ULC markings.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

### **Part 2 Products**

#### **2.1 INSULATION**

- .1 Mineral Fibre: Glass fibre, rock wool, or slag wool.
- .2 Fire/Smoke Rating: To CAN/ULC-S102:
  - .1 Maximum flame-spread rating: 25.
  - .2 Maximum smoke developed classification: 50.
- .3 Thermal conductivity ("k" factor) not to exceed specified values at 24 °C mean temperature when tested in accordance with ASTM C335/C335M.
- .4 Type C-1: Rigid mineral fibre board to CAN/ULC S702.1 or ASTM C612, with factory applied FSK vapour retarder jacket.



- .5 Type C-2: Mineral fibre blanket to CAN/ULC S702.1 or ASTM C553 faced with factory applied FSK vapour retarder jacket.

## **2.2 JACKETS**

- .1 Aluminum jacketing: To ASTM C1729:
  - .1 Type: I (bare exterior surface).
  - .2 Grade: 1 (3003 or 3015 aluminum alloy, H14 temper).
  - .3 Class: A (0.09 mm (3 mils) polyfilm interior surface coating).
  - .4 Thickness: To ASTM C1729 (0.41 - 0.61 mm).
  - .5 Finish: Smooth.
  - .6 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.
  - .7 Jacketing elbows: Factory fabricated, 2-piece, smooth finish, Type I (bare exterior), Grade 3 (1100 aluminum alloy), Class A (polyfilm interior coating).
- .2 Jacketing Tape: Multi-layer laminated sheet tape with a cold weather acrylic adhesive:
  - .1 Requirements: Zero permeability, resistant to weathering, mold, UV, extreme weather.
  - .2 Maximum Flame and Smoke Spread Rating (to CAN/ULC S102): 25/25.
  - .3 Service Temperature: -70 °C to 149 °C.
  - .4 Finish: Bare Aluminum, Smooth.
  - .5 Thickness: 0.18 mm (7 mils).

## **2.3 ACCESSORIES**

- .1 Vapour Retarder Lap Adhesive: Water based, fire retardant type, and compatible with insulation.
- .2 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: Hydraulic setting on mineral wool, to ASTM C449.
- .4 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .5 Contact Adhesive: Quick-setting
- .6 Tie wire: 1.5 mm stainless steel.
- .7 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .8 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Verify that pressure testing of ductwork systems is complete, witnessed, and certified.
- .2 Verify that surfaces are clean, dry, and free from foreign material.

### 3.2 INSTALLATION

- .1 Install to manufacturer's instructions, and in accordance with MICA National Commercial and Industrial Insulation Standards Manual.
- .2 Apply materials in accordance with manufacturer's instructions.
- .3 For Fire Wrap Insulation, manufacturer's tested and listed system installation details provided in shop drawings shall be strictly followed for each specific application. This includes repair of any damaged sections.
- .4 Use two layers of insulation with staggered joints when required nominal thickness exceeds 75 mm.
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes. Duct insulation shall be continuous through wall and ceiling openings and sleeves, except where firestopping is required:
  - .1 Ensure hangers and supports are outside vapour retarder jacket and in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .6 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .7 Fasteners: Install at 300 mm on centre in horizontal and vertical directions, minimum two rows each side.
- .8 At chilled ductwork, secure with banding. Fasteners penetrating or puncturing the underlying vapour barrier are not acceptable.

### 3.3 SITE QUALITY CONTROL

- .1 Non-Conforming Work:
  - .1 Replace insulation with vapour barrier damage and moisture-saturated insulation.

### 3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation Types and Thicknesses: Conform to following table:

Application	Type	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	50
Round cold and dual temperature supply air ducts	C-2	Yes	50
Exhaust duct between dampers and louvres	C-1	Yes	50

- .2 Insulation Finishes:

Application	Rectangular	Round
Indoor, concealed	None	None
Indoor, exposed within mechanical room	Jacketing Tape	Aluminum Jacket
Indoor, exposed elsewhere	Jacketing Tape	Aluminum Jacket
Outdoor	Jacketing Tape	Aluminum Jacket

### **3.5 CLEANING**

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

**END OF SECTION**

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**Part 1            General**

**1.1               SUMMARY**

- .1       Section Includes: Thermal insulation for HVAC piping and piping accessories.

**1.2               DEFINITIONS**

- .1       For the purposes of this Section:
  - .1       Concealed means insulated mechanical services in suspended ceilings, or in non-accessible chases, or in furred-in spaces.
  - .2       Exposed means not concealed.
  - .3       Jacketing is synonymous with insulation cladding and lagging.
  - .4       Mineral fibre is synonymous with glass fibre, rock wool, or slag wool.

**1.3               REFERENCE STANDARDS**

- .1       American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
  - .1       ANSI/ASHRAE/IES 90.1-2022, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2       ASTM International (ASTM):
  - .1       ASTM C335/C335M-23, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.
  - .2       ASTM C449/C449M-07 (2024), Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .3       ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - .4       ASTM C1729-21, Standard Specification for Aluminum Jacketing for Insulation.
- .3       Midwest Insulation Contractors Association (MICA):
  - .1       North American Commercial and Industrial Insulation Standards (NACIIS) Manual, 9<sup>th</sup> Edition.
- .4       ULC Standards (ULC):
  - .1       CAN/ULC-S102-19 (R2024), Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2       CAN/ULC-S702.1-21, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

**1.4               ACTION AND INFORMATIONAL SUBMITTALS**

- .1       Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2       Shop Drawings:
  - .1       Submit a schedule with a list of insulation for each service location, insulation type, thickness, and jacketing type.

- .2 Submit manufacturer's product literature, specifications, and datasheets. Include product characteristics, performance criteria, and limitations.

## **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: Specialist in performing work of this Section with at least three years successful experience in this type and size of project, member of Thermal Insulation Association of Canada (TIAC).

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address, and ULC markings.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 DESCRIPTION**

- .1 Regulatory Requirements:
  - .1 Combustible piping materials, including adhesives in accordance with CAN/ULC-S102:
    - .1 Flame-spread rating: Maximum 25.
    - .2 Smoke developed classification: Maximum 50.

### **2.2 INSULATION**

- .1 Thermal conductivity ("k" factor) not to exceed specified values at 24 °C mean temperature when tested in accordance with ASTM C335/C335M.
- .2 Type A-1: Rigid moulded mineral fibre without factory-applied vapour retarder jacketing:
  - .1 Mineral fibre: To CAN/ULC-S702.1.
  - .2 Maximum "k" factor: To CAN/ULC-S702.1.
- .3 Type A-3: Rigid moulded mineral fibre with factory-applied vapour retarder jacketing:
  - .1 Mineral fibre: To CAN/ULC-S702.1.

- .2 Jacketing: To ASTM C921.
- .3 Maximum "k" factor: To CAN/ULC-S702.1.
- .4 Type A-6: Flexible unicellular tubular elastomer:
  - .1 Insulation: With vapour retarder jacket.
  - .2 Jacketing: To ASTM C921.
  - .3 Maximum "k" factor: 0.04 W/m·K.
  - .4 Certified by manufacturer as free of potential stress corrosion cracking corrosive substances.

## 2.3 JACKETING

- .1 Polyvinyl Chloride (PVC) Jacketing:
  - .1 One-piece moulded type and sheet, in accordance with ASTM C921, with pre-formed shapes as required.
  - .2 Minimum service temperature: -20 °C.
  - .3 Maximum service temperature: 65 °C.
  - .4 Moisture vapour transmission: Maximum 0.02 perm.
  - .5 Thickness: 0.51 mm (20 mils).
  - .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 Covering adhesive: Compatible with insulation.
- .2 Aluminum Jacketing: To ASTM C1729:
  - .1 Thickness: Minimum 0.50 mm sheet. Thickness based on the outer diameter of the insulation in accordance with ASTM C1729.
  - .2 Finish: Smooth.
  - .3 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
  - .4 Fittings: Minimum 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
  - .5 Jacket banding and mechanical seals: Stainless steel, 19 mm wide, minimum 0.5 mm thick at 300 mm spacing.
  - .6 Jacketing elbows: Factory fabricated, same material as adjacent straight jacketing, 2-piece, smooth finish, Class A.

## 2.4 ACCESSORIES

- .1 Weatherproof Sealant for Jackets Installed Outdoors: In accordance with Section 07 92 00 - Joint Sealants.
- .2 Tape: Self-adhesive, aluminum, reinforced, minimum 50 mm wide.

- .3 Contact Adhesive: Quick setting type.
- .4 Canvas Adhesive: Washable.
- .5 Tie Wire: Stainless steel, minimum 1.5 mm diameter.
- .6 Bands: Stainless steel, 19 mm wide, minimum 0.5 mm thick.
- .7 Thermal Insulating and Finishing Cement: To ASTM C449, hydraulic setting type on mineral wool.
- .8 Vapour Retarder Lap Adhesive: Water-based and fire retardant type, compatible with insulation.
- .9 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.
- .10 Outdoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Verify that pressure testing of piping systems and adjacent equipment is complete, witnessed, and certified.
- .2 Verify that surfaces are clean, dry, and free from foreign material.

#### **3.2 INSTALLATION**

- .1 Install to manufacturer's instructions and in accordance with MICA, North American Commercial and Industrial Insulation Standards (NACIIS) Manual.
- .2 Provide two layers of insulation with staggered joints when required nominal wall thickness exceeds 75 mm.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .4 Install piping insulation continuous through wall and ceiling openings and sleeves.
- .5 Supports and Hangers:
  - .1 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .2 Install hangers and supports outside vapour retarder jacket.
  - .3 Apply high compressive strength insulation that is suitable for HVAC piping service at oversized saddles and shoes where insulation saddles have not been provided.

#### **3.3 INSTALLATION - ELASTOMERIC INSULATION**

- .1 Insulation to remain dry.
- .2 Provide vapour retarder as recommended by manufacturer.

#### **3.4 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings, unless otherwise specified.

- .2 Type: A-1:
  - .1 Securements: Stainless steel wire at 300 mm on centre.
  - .2 Seals: Lap seal adhesive, lagging adhesive.
- .3 Type: A-3:
  - .1 Securements: Stainless steel wire at 300 mm on centre.
  - .2 Seals: Vapour retarder lap seal adhesive, vapour retarder lagging adhesive.
- .4 Type: A-6:
  - .1 Securements: to manufacturer's requirements.
  - .2 Seals: Lap seal adhesive, lagging adhesive.
- .5 Provide insulation thickness as listed in the following table.
  - .1 Run-out: Branch piping to individual units and equipment not exceeding 4.000 mm long:

Application	Temperature	Piping Insulation Type	Run-out	Pipe sizes (NPS) to 1	Pipe sizes (NPS) 1 1/4 to 2	Pipe sizes (NPS) 2 1/2 to 4	Pipe sizes (NPS) 5 to 6	Pipe sizes (NPS) 8 & over
Refrigerant	4 - 13 °C	A-6	25 mm	25 mm	25 mm	25 mm	25 mm	25 mm
Refrigerant	Below 4 °C	A-6	25 mm	25 mm	38 mm	38 mm	38 mm	38 mm
Cooling Coil Condensate Drain		A-3	25 mm	25 mm	25 mm	25 mm	25 mm	25 mm

- .6 Finishes:
  - .1 Exposed indoors: PVC jacketing.
  - .2 Exposed in mechanical rooms: PVC jacketing.
  - .3 Concealed, indoors: No additional finish.
  - .4 Outdoors: Waterproof aluminum jacketing.
  - .5 Finish attachments: Stainless steel bands, at 300 mm on centre.
  - .6 Seals: Wing.

### 3.5 SITE QUALITY CONTROL

- .1 Non-Conforming Work: Replace insulation where there is damage to the vapour barrier and insulation is saturated with moisture.

### 3.6 CLEANING

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



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

**END OF SECTION**

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**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

**1.2 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 ASTM E202-18, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, and limitations.
  - .2 Submit 2 copies of WHMIS 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 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
- .4 Packaging Waste Management: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

**Part 2 Products**

**2.1 CLEANING SOLUTIONS**

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

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**Part 3            Execution**

**3.1                MANUFACTURER'S INSTRUCTIONS**

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

**3.2                CLEANING**

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

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1 ASME:
  - .1 ASME B16.22-21, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
  - .2 ASME B16.24-21, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500, and 2500.
  - .3 ASME B16.26-18, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .4 ASME B31.5-22, Refrigeration Piping and Heat Transfer Components.
- .2 ASTM International (ASTM):
  - .1 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.
  - .2 ASTM B280-20, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 CSA Group (CSA):
  - .1 CSA B52-18, B52 Package, Mechanical Refrigeration Code.
- .4 Environment Canada (EC):
  - .1 EPS 1/RA/1-15 (E2021), Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.
- .5 Government of Canada, Department of Justice (DOJ):
  - .1 Canadian Environmental Protection Act (CEPA), 1999:
    - .1 SOR/2022-110, Federal Halocarbon Regulations, 2022.

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for refrigerant piping, fittings, and equipment 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 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 TUBING**

- .1 Processed for refrigeration installations, deoxidized, dehydrated, and sealed:
  - .1 Hard copper: to ASTM B280, type ACR.
  - .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

### **2.2 FITTINGS**

- .1 Service: design pressure 3,100 kPa and temperature 121 °C.
- .2 Brazed:
  - .1 Fittings: wrought copper to ASME B16.22.
  - .2 Joints: silver solder, 15% Ag-80% Cu-5%P and non-corrosive flux.
- .3 Flanged:
  - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
  - .2 Gaskets: suitable for service.
  - .3 Bolts, nuts, and washers: to ASTM A307, heavy series.
- .4 Flared:
  - .1 Bronze or brass, for refrigeration, to ASME B16.26.

### **2.3 PIPE SLEEVES**

- .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

### **2.4 VALVES**

- .1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

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**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 GENERAL**

- .1 Install in accordance with CSA B52, Federal Halocarbon Regulations, EPS1/RA/1, ASME B31.5, and Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

**3.3 BRAZING PROCEDURES**

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, and sight glass.
- .3 Do not apply heat near expansion valve and bulb.

**3.4 PIPING INSTALLATION**

- .1 General:
  - .1 Soft annealed copper tubing: bend without crimping or constriction.
  - .2 Hard drawn copper tubing: do not bend. Minimize use of fittings.

**3.5 PRESSURE AND LEAK TESTING**

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively.
- .3 Test procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

**3.6 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13 °C for at least 12 hours before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

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- .6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
    - .1 Twice to 14 Pa absolute and hold for 4 hours.
    - .2 Break vacuum with refrigerant to 14 kPa.
    - .3 Final to 5 Pa absolute and hold for at least 12 hours.
    - .4 Isolate pump from system, record vacuum, and time readings until stabilization of vacuum.
    - .5 Submit test results to DCC Representative.
  - .7 Charging:
    - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
    - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
    - .3 Re-purge charging line if refrigerant container is changed during charging process.
  - .8 Checks:
    - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
    - .2 Record and report measurements to DCC Representative.
  - .9 Manufacturer's Field Services:
    - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection, and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
    - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
    - .3 Schedule site visits, to review Work, at stages listed:
      - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
      - .2 Twice during progress of Work at 25% and 60% complete.
      - .3 Upon completion of the Work, after cleaning is carried out.
    - .4 Obtain reports, within 3 days of review, and submit, immediately, to DCC Representative.

### **3.7 CLEANING**

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

**END OF SECTION**



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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- .2 ASTM International (ASTM):
  - .1 ASTM A480/A480M-23, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A653/A653M-22, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 National Fire Protection Association (NFPA):
  - .1 NFPA 96-24, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
  - .1 HVAC Duct Construction Standards - Metal and Flexible, 4<sup>th</sup> Edition, 2020.
  - .2 HVAC Air Duct Leakage Test Manual, 2<sup>nd</sup> Edition, 2012.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**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 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

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**Part 2            Products**

**2.1                SEAL CLASSIFICATION**

- .1    Seal classification:
  - .1        Class A: longitudinal seams, transverse joints, duct wall penetrations, and connections made airtight with sealant and tape.

**2.2                SEALANT**

- .1    Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 °C to plus 93 °C.

**2.3                TAPE**

- .1    Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

**2.4                DUCT LEAKAGE**

- .1    In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

**2.5                FITTINGS**

- .1    Fabrication: to SMACNA.
- .2    Radiused elbows:
  - .1        Rectangular: standard radius.
  - .2        Round: 5-piece, centreline radius: 1.5 times diameter.
- .3    Mitred elbows, rectangular:
  - .1        To 407 mm: with single thickness turning vanes.
  - .2        Over 407 mm: with double thickness turning vanes.
- .4    Branches:
  - .1        Rectangular main and branch: with 45 degrees entry on branch.
  - .2        Round main and branch: enter main duct at 45 degrees with conical connection.
  - .3        Provide volume control damper in branch duct near connection to main duct.
  - .4        Main duct branches: with splitter damper.
- .5    Transitions:
  - .1        Diverging: 20 degrees maximum included angle.
  - .2        Converging: 30 degrees maximum included angle.
- .6    Offsets:
  - .1        As indicated.
- .7    Obstruction deflectors: maintain full cross-sectional area:
  - .1        Maximum included angles: as for transitions.

**2.6                GALVANIZED STEEL**

- .1    Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

## **2.7 HANGERS AND SUPPORTS**

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment:
  - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct:
    - .1 Maximum size duct supported by strap hanger: 500.
  - .2 Hanger configuration: to SMACNA.
  - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA.
  - .4 Upper hanger attachments:
    - .1 For concrete: manufactured concrete inserts.
    - .2 For steel joist: manufactured joist clamp.
    - .3 For steel beams: manufactured beam clamps.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 GENERAL**

- .1 Do work in accordance with ASHRAE and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods:
  - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.
- .4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .5 Manufacture duct in width/height and diameter to accommodate installation of acoustic duct lining. Dimensions indicated are clear inside.

### **3.3 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.

- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA.

### **3.4 WATERTIGHT DUCT**

- .1 Provide watertight duct for:
  - .1 Fresh air intake.
  - .2 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams.
  - .1 Weld joints of bottom and side sheets.
  - .2 Seal other joints with duct sealer.
- .3 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and discharging to funnel floor drain.

### **3.5 SEALING AND TAPING**

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

### **3.6 LEAKAGE TESTS**

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage tests in sections.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Do not install additional ductwork until trial test has been passed.
- .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .6 Complete test before performance insulation or concealment Work.

### **3.7 CLEANING**

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

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
  - .1 HVAC Duct Construction Standards - Metal and Flexible, 4<sup>th</sup> Edition, 2020.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 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.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

**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 matching duct sheet metal thickness with fabric clenched by means of double locked seams.

- .2 Material:
  - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 °C to plus 90 °C, density of 1.3 kg/m<sup>2</sup>.

## **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 1,000 mm: piano hinge and minimum two sash locks.
  - .4 Doors over 1,000 mm: piano hinge and two handles operable from both sides.
  - .5 Hold open devices.

## **2.4 TURNING VANES**

- .1 Factory or shop fabricated single or double thickness as indicated, to recommendations of SMACNA.

## **2.5 INSTRUMENT TEST**

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

# **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:
    - .1 600 x 600 mm for person size entry.
    - .2 300 x 300 mm for servicing entry.
    - .3 150 x 150 mm for viewing.
    - .4 As indicated.
  - .2 Locations:
    - .1 Fire and smoke dampers.
    - .2 Control dampers.
    - .3 Devices requiring maintenance.
    - .4 Required by code.
    - .5 Reheat coils.
    - .6 Elsewhere as indicated.
- .3 Instrument Test Ports:
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .3 Install insulation port extensions as required.
  - .4 Locations:
    - .1 For traverse readings:
      - .1 Ducted inlets to roof and wall exhausters.
      - .2 Inlets and outlets of other fan systems.
      - .3 Main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 At outside air intakes.
      - .2 At inlet and outlet of coils.
      - .3 And as indicated.
- .4 Turning Vanes:
  - .1 Install in accordance with recommendations of SMACNA and as indicated.

### **3.2 CLEANING**

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

**END OF SECTION**



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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
  - .1 HVAC Duct Construction Standards - Metal and Flexible, 4<sup>th</sup> Edition, 2020.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for dampers 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 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

**Part 2 Products**

**2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2 SINGLE BLADE DAMPERS**

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 200 mm for rectangular ducts.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

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**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 damper installation in accordance with manufacturer's written instructions:
  - .1          Visually inspect substrate in presence of DCC Representative.
  - .2          Inform DCC Representative of unacceptable conditions immediately upon discovery.
  - .3          Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

**3.2                INSTALLATION**

- .1      Install 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.

**3.3                CLEANING**

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

**END OF SECTION**

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**Part 1        General**

**1.1            REFERENCE STANDARDS**

- .1        American National Standards Institute/Air Movement and Control Association (ANSI/AMCA):
  - .1        ANSI/AMCA Standard 99-2016, Standards Handbook.
  - .2        ANSI/AMCA 210-16 (ANSI/ASHRAE 51-16), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3        ANSI/AMCA Standard 300-2014, Reverberant Room Method for Sound Testing of Fans.
  - .4        ANSI/AMCA Standard 301-2022, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Shop Drawings:
  - .1        Submit manufacturer's instructions, printed product literature, and data sheets for HVAC fans and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2        Provide:
    - .1        Fan performance curves showing point of operation, bhp, and efficiency.
    - .2        Sound rating data at point of operation.
  - .3        Indicate:
    - .1        Motors, sheaves, bearings, and shaft details.
    - .2        Minimum performance achievable with variable speed controllers.

**1.3            MAINTENANCE MATERIAL SUBMITTALS**

- .1        Extra Materials:
  - .1        Submit in accordance with Section 01 78 00 - Closeout Submittals:
    - .1        Provide:
      - .1        Matched sets of belts.
      - .2        Furnish list of individual manufacturer's recommended spare parts for equipment, include:
        - .1        Bearings and seals.
        - .2        Addresses of suppliers.
        - .3        List of specialized tools necessary for adjusting, repairing, or replacing.

## **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 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, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **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, sound power data, and as indicated on schedule.
  - .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
  - .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.
  - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

### **2.2 IN-LINE CENTRIFUGAL FANS**

- .1 Wheel:
  - .1 Constructed of aluminum.
  - .2 Wheel type to be non-overloading, backward inclined centrifugal wheel.
  - .3 Statically and dynamically balanced in accordance to ANSI/AMCA Standard 204.
  - .4 The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency.

- .2 Motor:
  - .1 Direct drive, AC Induction Motor:
    - .1 Motor enclosures: Totally enclosed.
    - .2 Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and be pre-wired to the specific voltage and phase.
- .3 Housing/Cabinet Construction:
  - .1 Construction material: Galvanized.
  - .2 Square design constructed of heavy gauge galvanized steel.
- .4 Inlet Cone:
  - .1 Construction material: Galvanized.
- .5 Housing Supports and Drive Frame:
  - .1 Drive frame shall be constructed of structural steel with formed flanges.
- .6 Duct Collar:
  - .1 Square Duct Mounting Collar:
    - .1 Inlet and discharge collars to provide easy slip-fit duct connection.
    - .2 Square design to provide a large discharge area.
- .7 Access Panel:
  - .1 Two-sided access panels to permit easy access to all internal components.
  - .2 Located perpendicular to the motor mounting panel.
- .8 Options/Accessories:
  - .1 Damper:
    - .1 Type: Gravity.
    - .2 Galvanized frames with prepunched mounting holes.
    - .3 Balanced for minimal resistance to flow.

## **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 HVAC fans 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 FAN INSTALLATION**

- .1 Install fans as indicated, complete with manufacturer supplied 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.
- .4 Access doors and access panels to be easily accessible.

### **3.3 CLEANING**

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

**END OF SECTION**

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**Part 1            General**

**1.1            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Shop Drawings:
  - .1    Submit manufacturer's instructions, printed product literature, and data sheets for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2    Indicate following:
    - .1    Capacity.
    - .2    Throw and terminal velocity.
    - .3    Noise criteria.
    - .4    Pressure drop.
    - .5    Neck velocity.

**1.2            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.

**1.3            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    Delivery and Acceptance Requirements:
  - .1    Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3    Storage and Handling Requirements:
  - .1    Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

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**Part 2 Products**

**2.1 GENERAL**

- .1 Grilles, registers and diffusers of same generic type, and products of one manufacturer.
- .2 To meet capacity, pressure drop, terminal velocity, throw, noise level, and neck velocity as indicated:
  - .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.
- .3 Refer to drawing schedules.
- .4 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames where set into plaster or gypsum board.
  - .3 Concealed fasteners.
- .5 Volume control dampers: as indicated on drawing schedules.
- .6 Colour: standard.

**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 diffuser, register, and grille installation in accordance with manufacturer's written instructions:
  - .1 Visually inspect substrate in presence of DCC Representative.
  - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

**3.2 INSTALLATION**

- .1 Install in accordance with manufacturers instructions.
- .2 Install with oval head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers, and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register, and diffuser in gymnasium and similar game rooms and elsewhere as indicated.

**3.3 CLEANING**

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



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

**END OF SECTION**

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**Part 1            General**

**1.1               REFERENCE STANDARDS**

- .1 National Fire Protection Association (NFPA):
  - .1 NFPA 96-24, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- .3 Society of Automotive Engineers (SAE).

**1.2               ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .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.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

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**Part 2 Products**

**2.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

**2.2 FIXED LOUVRES - ALUMINUM**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1,500 mm.
- .4 Frame, head, sill, and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer, and aluminum body.
- .6 Screen: 12.7 mm mesh, 2 mm diameter wire aluminum bird screen on inside face of louvres in formed U-frame.
- .7 Finish: factory primed and baked enamel resin coating. Colour: to DCC Representative's approval.

**Part 3 Execution**

**3.1 EXAMINATION**

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

**3.2 INSTALLATION**

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

**3.3 CLEANING**

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

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

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1    CSA Group (CSA):
  - .1    CSA B52-05 (R2009), Mechanical Refrigeration Code.
  - .2    CAN/CSA-C656-05 (R2010), Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.

**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 air conditioning components and accessories and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3    Shop Drawings:
  - .1    Indicate on drawings:
    - .1    Major components and accessories including sound power levels of units.
    - .2    Type of refrigerant used.

**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 VRF Equipment for incorporation into manual.

**1.4            DELIVERY, STORAGE, AND HANDLING**

- .1    Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2    Delivery and Acceptance Requirements:
  - .1    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, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

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**Part 2            Products**

**2.1                VRF SYSTEM**

- .1 Outdoor Unit (OU-#):
  - .1 General:
    - .1 The outdoor unit shall be capable of the following ambient operating range:
      - .1 Cooling: -10 °C DB to 48 °C DB.
      - .2 Heating: -20 °C WB to 18 °C WB.
    - .2 The air-conditioning system shall use R-32 refrigerant.
    - .3 The system shall have one air source outdoor unit.
    - .4 The refrigerant circuit shall be field piped to a single matching indoor unit to effectively and efficiently control the heating or cooling operation of the system.
    - .5 All refrigerant piping from outdoor unit to indoor unit shall be field insulated.
    - .6 The outdoor unit shall be internally assembled, wired and piped from the factory.
    - .7 The factory assembled system shall have the outdoor unit fitted with refrigerant strainer, check valves, oil separator, accumulator, 4-way reversing valve, electronic expansion valve, high side and low side refrigerant charging ports, and a service port.
  - .2 Casing:
    - .1 The outdoor unit cabinet shall be made of Pre-Coated Metal (PCM).
    - .2 The front/side panels of the outdoor unit shall be removable type for access to internal components.
    - .3 Outdoor unit cabinet shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1,000 hours.
  - .3 Refrigerant System:
    - .1 The refrigeration system consists of a single refrigeration circuit and uses R-32 refrigerant.
    - .2 R-454b refrigerant is an acceptable alternative.
  - .4 Compressors:
    - .1 The outdoor unit shall be equipped with one hermetically sealed, digitally controlled inverter driven twin-rotary compressor.
    - .2 The compressor shall be mounted on vibration attenuating rubber grommets.
    - .3 The compressor shall use a factory charge of Polyvinyl Ether (PVE) oil.
    - .4 The compressor bearing(s) shall be coated.
    - .5 The compressor shall be equipped with over-current protection.

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- .5 Outdoor Unit Coil:
    - .1 The outdoor unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
    - .2 Coil coating shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1,000 hours.
    - .3 The outdoor unit coil shall be factory tested to a pressure of 600 psig.
    - .4 The coil for each outdoor unit shall have a minimum of 14 Fins Per Inch (FPI).
    - .5 The coil for each outdoor unit shall have a 2 row heat exchanger.
    - .6 The outdoor unit cabinet shall have a coil guard.
  - .6 Fans and Motors:
    - .1 The outdoor unit shall be equipped with one direct drive variable speed propeller fan with Brushless Digitally Controlled (BLDC) motor with a horizontal air discharge.
    - .2 The fan shall be equipped with permanently lubricated bearings.
    - .3 The fan shall have a raised guard to help prevent contact with moving parts.
  - .7 Electrical
    - .1 Outdoor units are 208 – 230 V/60 Hz/1-phase. The unit shall include over/under voltage protection.
  - .8 Controls:
    - .1 Factory installed microprocessor controls in the outdoor unit and indoor unit shall perform functions to efficiently operate the single zone system and communicate via minimum 18 AWG, 4 conductor, stranded, shielded or unshielded power/communication cable. If shielded, it must be grounded to chassis at ODU only.
  - .9 Equipment Stand:
    - .1 Outdoor unit shall be furnished with a pre-manufactured field-supplied stand. minimum 450 mm (18") tall. Stand must comply with outdoor unit manufacturer's installation instructions, be rated for the unit weight, and align with and fully support all base rails and connection points of the unit. Stands must be bolted to the concrete pad.
  - .2 Ducted Indoor Unit (IU-#):
    - .1 General:
      - .1 The wall-mounted indoor unit shall be factory assembled, wired, and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

- .2 Unit Cabinet:
  - .1 All casings, regardless of model size, shall have the same white finish.
  - .2 Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining are required.
  - .3 There shall be a separate back plate which secures the unit firmly to the wall.
- .3 Fan:
  - .1 The indoor unit fan shall include ECM motor.
  - .2 The indoor fan shall be statically and dynamically balanced to run on a single motor with permanently lubricated bearings.
  - .3 A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
  - .4 A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
- .4 Air Filter:
  - .1 Return air shall be filtered by means of an easily removable, washable filter.
- .5 Indoor Unit Coil:
  - .1 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy.
  - .2 The coils shall be pressure tested at the factory.

### **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 air conditioning components installation in accordance with manufacturer's written instructions:
  - .1 Visually inspect substrate in presence of DCC Representative.
  - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

#### **3.2 GENERAL**

- .1 Manufacturer to certify installation.
- .2 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.



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**3.3 EQUIPMENT PREPARATION**

- .1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

**3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.5 PROTECTION**

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

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1 Canada Green Building Council (CaGBC):
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
  - .4 LEED Canada-EB: O&M-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .2 CSA Group (CSA):
  - .1 CSA C22.2 No.46-M1988 (R2006), Electric Air-Heaters.
- .3 National Electrical Manufacturers Association (NEMA):
  - .1 NEMA 250-08, Enclosures for Electrical Equipment (1,000 V Maximum).

**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 unit heaters 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 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **Part 2 Products**

### **2.1 UNIT HEATERS**

- .1 Unit heater: to CSA C22.2 No. 46, horizontal discharge complete with adjustable louvers finished to match cabinet.
- .2 Fan type unit heaters with built-in high-heat limit protection, fan-delay switches.
- .3 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount explosion proof:
  - .1 Built-in fan motor thermal overload protection.
- .4 Hangers: as indicated.
- .5 Elements: mineral insulated stainless steel sheath with aluminum, brazed fins:
  - .1 Explosion proof with sealed steel tube core with aluminum fin.
- .6 Cabinet: steel, 1 mm thick, fitted with supplied brackets for rod or wall mounting.
- .7 Electrical:
  - .1 The unit heaters are 208 - 230 V/60 Hz/1-phase.
  - .2 Provide disconnect switch with units.

### **2.2 CONTROLS**

- .1 Wall mounted thermostats: type electronic, Energy Star certified.

## **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 unit heaters installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of DCC Representative.
  - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

### **3.2 INSTALLATION**

- .1 Suspend unit heaters from ceiling or mount on wall as indicated.
- .2 Install thermostats in locations indicated.
- .3 Make power and control connections.

### **3.3 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 shut down.
- .4 Test unit cut-off when fan motor overload protection has operated.
- .5 Ensure heaters and controls operate correctly.

### **3.4 CLEANING**

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

### **3.5 PROTECTION**

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

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 CSA Group:
  - .1 CSA C22.1:24 Canadian Electrical Code, Part I (26<sup>th</sup> Edition), Safety Standard for Electrical Installations.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for electrical equipment and include product characteristics, performance criteria, physical size, finish, and limitations.
- .2 Certificates:
  - .1 Provide CSA certified equipment and material.
  - .2 Submit test results of installed electrical systems and instrumentation.
  - .3 Permits and fees: in accordance with General Conditions of contract.
  - .4 Submit certificate of acceptance from Authority Having Jurisdiction upon completion of Work to DCC Representative.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: submit operation and maintenance data for electrical equipment 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.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with manufacturer recommendations.
- .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, and well-ventilated area.
  - .2 Store and protect equipment and materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **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.

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from Authority Having Jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Factory assemble control panels and component assemblies.

### **2.3 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment, and controls, as indicated.

### **2.4 WIRING TERMINATIONS**

- .1 Ensure lugs, terminals, and screws used for termination of wiring are suitable for either copper or aluminum conductors.

### **2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates or labels as follows:
  - .1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core.

- .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 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary, and secondary voltages.

## 2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered 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

## 2.7 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.

Type	Prime	Auxiliary
Up to 250 V	Yellow	
Up to 600 V	Yellow	Green

## 2.8 FINISHES

- .1 Except in the case of stainless steel, shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

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**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                CONDUIT AND CABLE INSTALLATION**

- .1        Install conduit and sleeves prior to pouring of concrete.
  - .1        Sleeves through concrete: plastic, 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.

**3.4                LOCATION OF OUTLETS**

- .1        As indicated on drawings.

**3.5                MOUNTING HEIGHTS**

- .1        If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .2        Install electrical equipment at following heights unless indicated otherwise.
  - .1        Local switches: 1,400 mm.
  - .2        Wall receptacles:
    - .1        General: 300 mm.
  - .3        Panelboards: as required by Code or as indicated.

**3.6                CO-ORDINATION OF PROTECTIVE DEVICES**

- .1        Ensure circuit protective devices such as overcurrent trips, relays, and fuses are installed to required values and settings.

**3.7                FIELD QUALITY CONTROL**

- .1        Conduct following tests in accordance with Section 01 45 00 - Quality Control:
  - .1        Circuits originating from branch distribution panels.
  - .2        Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.



- .3 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 1,000 V instrument.
  - .3 Check resistance to ground before energizing.
- .2 Carry out tests in presence of DCC Representative.
- .3 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of project.
- .4 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.8 SYSTEM STARTUP**

- .1 Instruct DCC Representative in operation, care and maintenance of systems, system equipment, and components.
- .2 Arrange for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

### **3.9 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment.
- .3 Waste Management:
  - .1 Separate waste materials for reuse and recycling.
  - .2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 CSA Group (CSA):
  - .1 CAN/CSA-C22.2 No.18-98 (R2003), Outlet Boxes, Conduit Boxes and Fittings.
  - .2 CAN/CSA-C22.2 No.65-18 (R2022), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):
  - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1,200 Ampere Maximum Rating).

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 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.
- .2 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store materials indoors, in dry location, off ground, and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

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**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                INSTALLATION**

- .1      Remove insulation carefully from ends of conductors cables, and:
  - .1      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.
  - .2      Install fixture type connectors and tighten to CAN/CSA-C22.2 No. 65. Replace insulating cap.
  - .3      Install bushing stud connectors in accordance with EEMAC 1Y-2.

**3.3                CLEANING**

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

**END OF SECTION**

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**Part 1            General**

**1.1               DELIVERY, STORAGE, AND HANDLING**

- .1      Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2      Storage and Handling Requirements:
  - .1          Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2          Store and protect wiring devices from nicks, scratches, and blemishes.
  - .3          Replace defective or damaged materials with new.

**Part 2            Products**

**2.1               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, Jacketted.

**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 before energizing electrical system.

**3.2               GENERAL CABLE INSTALLATION**

- .1      Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors (0-1000 V).
- .2      Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3      Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

**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.
  - .2          In underground ducts in accordance with Division 33.

**END OF SECTION**

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**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.2 CLOSEOUT SUBMITTALS**

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

**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 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, and well-ventilated area.
  - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: sized to suit as indicated on drawings.
- .2 Rod electrodes: copper clad steel, 20 mm diameter by minimum 3 m long.
- .3 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .4 Insulated grounding conductors: green, copper conductors, size as indicated.
- .5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, and connectors.
- .6 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 Bonding jumpers and straps.

- .5 Pressure wire connectors.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

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

#### **3.2 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, and accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.

#### **3.3 ELECTRODES**

- .1 Install rod, plate electrodes and make grounding connections as indicated.
- .2 Bond separate, multiple electrodes together.
- .3 Use size 2/0 AWG copper conductors for connections to electrodes minimum unless indicated otherwise on drawings.
- .4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails.

#### **3.4 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections of primary and secondary systems as indicated.

#### **3.5 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, distribution panels, lighting, cable trays, and conduits.

### **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.

### **3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning & Waste Management:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 – Cleaning& Waste Management.

**END OF SECTION**

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**Part 1        General**

**1.1            DELIVERY, STORAGE, AND HANDLING**

- .1      Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2      Storage and Handling Requirements:
  - .1          Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2          Store and protect hangers and supports from nicks, scratches, and blemishes.
  - .3          Replace defective or damaged materials with new.

**Part 2        Products**

**2.1            SUPPORT CHANNELS**

- .1      U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

**Part 3        Execution**

**3.1            INSTALLATION**

- .1      Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .2      Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .3      Fasten exposed conduit or cables to building construction or support system using straps:
  - .1          One-hole malleable iron or 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.
- .4      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.
- .5      Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support conduit and cable runs.
- .6      Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .7      Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .8      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.



- .9 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:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment.
- .3 Waste Management:
  - .1 Separate waste materials for reuse and recycling.
  - .2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

**Part 2 Products**

**2.1 JUNCTION AND PULL BOXES**

- .1 Construction: PVC enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on covers.

**Part 3 Execution**

**3.1 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 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

**3.2 IDENTIFICATION**

- .1 Identification Labels: size 2 indicating system name or as indicated.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCE STANDARDS**

- .1 CSA Group (CSA):
  - .1 CSA C22.2 No. 18.3-12 (R2022), Conduit, Tubing, and Cable Fittings (Trinational Standard with ANCE NMX-J-017 and UL 514B).
  - .2 CSA C22.2 No. 83.1-07 (R2022), Electrical Metallic Tubing - Steel (Tri-National Standard, with UL 797 and NMX-J-536-ANCE-2007).
  - .3 CSA C22.2 No. 211.2-06 (R2021), Rigid PVC (Unplasticized) Conduit.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

## **Part 2 Products**

### **2.1 CONDUITS**

- .1 Electrical Metallic Tubing (EMT): to CSA C22.2 No. 83.
- .2 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .3 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.

### **2.3 CONDUIT FITTINGS**

- .1 Fittings: to CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90° 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 Surface mount conduits except as indicated.
- .3 Use Electrical Metallic Tubing (EMT) above 2.4 m not subject to mechanical injury and only inside exterior enclosures and buildings.
- .4 Use rigid PVC conduit for exposed exterior and underground installations.
- .5 Minimum conduit size for lighting and power circuits: 21 mm.
- .6 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10<sup>th</sup> of its original diameter.
- .7 Mechanically bend steel conduit over 19 mm diameter.
- .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .9 Install fish cord in empty conduits.
- .10 Remove and replace blocked conduit sections:
  - .1 Do not use liquids to clean out conduits.
- .11 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 Do not pass conduits through structural members except as indicated.
- .5 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 UNDERGROUND**

- .1 Slope conduits to provide drainage.

### **3.7 CLEANING**

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**

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**Part 1 General**

**1.1 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MARKERS**

- .1 Detectable warning tape buried above underground conduit runs.

**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 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.

### **3.3 MARKERS**

- .1 Install detectable warning tape continuously above underground conduit runs as indicated in drawing details.

### **3.4 FIELD QUALITY CONTROL**

- .1 Perform tests using qualified personnel:
  - .1 Include necessary instruments and equipment.
- .2 Check phase rotation and identify each phase conductor of each feeder.
- .3 Check each feeder for continuity, short circuits, and grounds:
  - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .4 Pre-acceptance tests:
  - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1,000 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.
- .5 Acceptance Tests:
  - .1 Ensure that terminations and accessory equipment are disconnected.
  - .2 Ground shields, ground wires, metallic armour and conductors not under test.
  - .3 High Potential (Hipot) Testing:
    - .1 Conduct hipot testing in accordance with manufacturer 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.
- .6 Provide DCC Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

### **3.5 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment.
- .3 Waste Management:
  - .1 Separate waste materials for reuse and recycling.
  - .2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.6 PROTECTION**

- .1 Repair damage to adjacent materials caused by cables installation.

**END OF SECTION**



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**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1    CSA Group (CSA):
  - .1        CSA C9-17 (R2022), Dry-Type Transformers.
- .2    National Electrical Manufacturers Association (NEMA).

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                CLOSEOUT SUBMITTALS**

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

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

**Part 2            Products**

**2.1                DESIGN DESCRIPTION**

- .1    Design:
  - .1        Type: K-factor rated per site standards.
  - .2        3 phase, Voltages and Ratings as per drawings, 60 Hz.
  - .3        Voltage taps: standard.
  - .4        Insulation: 150 Degree Temp rise.
  - .5        Basic Impulse Level (BIL): standard.
  - .6        Hipot: standard.

- .7 Average sound level: standard.
- .8 Impedance at 17 °C: standard.
- .9 Enclosure: NEMA 12.
- .10 Mounting: floor.
- .11 Finish: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .12 Copper windings.
- .13 Winding configuration: Delta Primary, Grounded-Wye Secondary. Equipment to be equipped with three primary windings of equal construction and three secondary windings of equal construction.
- .14 Voltage Regulation to be 4% or better.

## **2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification: in accordance with Section 26 05 00 - Common Work Results for Electrical.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION**

- .1 Mount dry type transformers as indicated on drawings.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Make primary and secondary connections in accordance with wiring diagram.
- .6 Energize transformers after installation is complete.

### **3.3 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment

- .3 Waste Management: Separate waste materials for recycling reuse:
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.4 PROTECTION**

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

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 CSA Group (CSA):
  - .1 CSA C22.2 No.29-15 (R2019), Panelboards and Enclosed Panelboards.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 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.
- .2 Shop Drawings:
  - .1 Include on drawings:
    - .1 Electrical detail of panel, branch breaker type, quantity, ampacity, and enclosure dimension.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: Submit operation and maintenance data for panelboards for incorporation into manual.

**1.4 DELIVERY, STORAGE, AND HANDLING**

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

**Part 2 Products**

**2.1 PANELBOARDS**

- .1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer:
  - .1 Install circuit breakers in panelboards before shipment.
  - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 Panelboards: bus and breakers rated as indicated on drawings. Interrupting capacity as indicated on drawings.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Copper bus with neutral of same ampere rating of mains.
- .6 Mains: suitable for bolt-on breakers.
- .7 Trim with concealed front bolts and hinges.
- .8 Trim and door finish: baked enamel.
- .9 Isolated ground bus.
- .10 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.
- .11 Enclosure: NEMA 12.

## **2.2 BREAKERS**

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on breaker devices installed as indicated. Turn over unused lock-on devices to DCC Representative.

## **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true, and square, to adjoining surfaces.
- .2 Connect loads to circuits.
- .3 Connect neutral conductors to common neutral bus with respective neutral identified.

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**3.3 CLEANING**

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

**3.4 PROTECTION**

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

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1    CSA Group (CSA):
  - .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 (R2022), Cover Plates for Flush-Mounted Wiring Devices (Bi-National Standard, with UL 514D).
  - .3        CSA C22.2 No. 55-M1986(R2008), Special Use Switches.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Product Data:
  - .1        Submit manufacturer's instructions, printed product literature, and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish, and limitations.

**1.3                CLOSEOUT SUBMITTALS**

- .1    Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1    Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2    Storage and Handling Requirements:
  - .1        Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2        Store and protect wiring devices from nicks, scratches, and blemishes.
  - .3        Replace defective or damaged materials with new.

**Part 2            Products**

**2.1                SWITCHES**

- .1    15 A, 120 V, single pole switches to: CSA C22.2 No. 55.
- .2    Manually-operated general purpose AC switches with following features:
  - .1        Terminal holes approved for No. 10 AWG wire.
  - .2        Suitable for back and side wiring.
  - .3        Switches are to be white in color.
- .3    As indicated on drawings.
- .4    Switches of one manufacturer throughout project.

## **2.2 RECEPTACLES**

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
  - .1 Suitable for No. 10 AWG for back and side wiring.
  - .2 Break-off links for use as split receptacles.
  - .3 Receptacles are to be white in color.
  - .4 Receptacles to be ground fault where indicated on drawings.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.

## **2.3 SPECIAL WIRING DEVICES**

- .1 Special wiring devices:
  - .1 Combination exterior audible/visual alarm device as indicated on drawings, 120 VAC, Surface Mountable, NEMA Type 3R enclosure minimum, Lamp/Lense color 'RED', LED Flashing, Alarm Horn/Buzzer 85 dB minimum output. CSA approved.

## **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 and recess-mounted utility boxes.

## **2.5 SOURCE QUALITY CONTROL**

- .1 Cover plates from one manufacturer throughout project.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

### **3.2 INSTALLATION**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Install GFI type receptacles as indicated.
- .3 Cover plates:
  - .1 Install suitable common cover plates where wiring devices are grouped.



- .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

### **3.3 CLEANING**

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

### **3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

**END OF SECTION**

## **Part 1 General**

### **1.1 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 NMX-J-266-ANCE-2010).

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish, and limitations.

### **1.3 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store circuit breakers off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 BREAKERS GENERAL**

- .1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 °C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Circuit breakers supplied with new panels to have minimum symmetrical RMS interrupting capacity rating as indicated on drawings.
- .4 Circuit breakers added to existing panels to have minimum symmetrical RMS interrupting capacity rating to match existing breakers in existing panelboards.

### **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.

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**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Install circuit breakers as indicated.

**3.2                CLEANING**

- .1            Progress Cleaning:
  - .1            Leave Work area clean at end of each day.
- .2            Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .3            Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.
- .4            Waste Management:
  - .1            Separate waste materials for reuse and recycling.
  - .2            Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 CSA Group:
  - .1 CAN/CSA-C22.2 No. 4-16 (R2020), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).

**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 disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish, and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 DISCONNECT SWITCHES**

- .1 Disconnect switch in CSA enclosure 3R, to 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 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

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**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                INSTALLATION**

- .1      Install disconnect switches complete with fuses if applicable.

**3.3                CLEANING**

- .1      Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1      Leave Work area clean at end of each day.
- .2      Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .3      Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1      Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

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**Part 1            General**

**1.1               REFERENCE STANDARDS**

- .1        CSA (Canadian Standards Association).
- .2        CSA C22.1 Canadian Electrical Code, Part I Safety Standard for Electrical Installations.

**1.2               ACTION SUBMITTALS**

- .1        Section 01 33 00: Submission procedures.
- .2        Product Data: Provide catalogue sheets showing voltage, switch size, ratings and size of switching and over-current protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

**1.3               INFORMATIONAL SUBMITTALS**

- .1        Section 01 33 00 – Submittal Procedures: Submission procedures.
- .2        Installation Data: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

**1.4               CLOSEOUT SUBMITTALS**

- .1        Section 01 78 00 – Closeout Submittals: Submission procedures.
- .2        Operation Data: Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions when engine generator is running.
- .3        Maintenance Data: Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

**1.5               DELIVERY, STORAGE, AND HANDLING**

- .1        Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- .2        Handle to manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

**Part 2            Products**

**2.1               DESCRIPTION**

- .1        Regulatory Requirements:
  - .1        Provide products listed and classified by CSA as suitable for purpose specified and indicated.

**2.2               MANUAL TRANSFER SWITCH**

- .1        Voltage: 120/208 volts, three-phase, four-wire, 60 Hz.

- .2 Switched Poles: Three (3). Solid Neutral.
- .3 Continuous Rating: 100 amperes.
- .4 NEMA Type 12 Enclosure Minimum (Wall Mountable).
- .5 (3) Three Position Operating Handle on door (Lockable in all 3 positions NORMAL-OFF-EMERG).
- .6 Suitable for Control of Motor Loads.
- .7 CSA Approved.

### **2.3 GENERATOR RECEPTACLE & ENCLOSURE**

- .1 Generator Receptacle: 100A Rated, Suitable for 120/208 V 3Ph 4W Connection.
- .2 Industrial Grade c/w Watertight Exterior Enclosure/Cover.
- .3 HP Rated, 600 VAC Max.
- .4 NEMA Type 3R Enclosure Minimum.
- .5 Receptacle Connection Type/Arrangement to be as per Site Requirements. Coordinate with DCC Representative.
- .6 CSA Approved.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install transfer switches and generator receptacles to manufacturer's written instructions.
- .2 Provide engraved plastic nameplates to requirements of Section 26 05 00 – Common Work Results for Electrical.

### **3.2 CLOSEOUT ACTIVITIES**

- .1 Demonstration: Demonstrate operation of transfer switch and Generator Receptacle in normal, and emergency modes.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 CSA Group (CSA):
  - .1 CSA C22.1:24 Canadian Electrical Code, Part I (26<sup>th</sup> Edition), Safety Standard for Electrical Installations.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Divert unused metal materials from landfill to metal recycling facility.

**Part 2 Products**

**2.1 LAMPS**

- .1 Install lamps and fixture types as indicated on drawings.

**2.2 LUMINAIRES**

- .1 As indicated in luminaire schedule.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated.

**3.2 WIRING**

- .1 Connect luminaires to lighting circuits:
  - .1 Install flexible and/or rigid conduit for luminaires as required by manufacturers installation instructions.

**3.3 LUMINAIRE SUPPORTS**

- .1 For suspended ceiling installations support luminaires independently of ceiling.

**3.4 CLEANING**

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

**END OF SECTION**



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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 21 - Wires and Cables (0-1000 V).
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

**1.2 REFERENCE STANDARDS**

- .1 CSA Group (CSA):
  - .1 CSA C22.2 No.141-15, Emergency Lighting Equipment.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 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 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in a clean, dry, and well-ventilated area.
  - .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**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 EQUIPMENT**

- .1 Emergency lighting equipment: to CSA C22.2 No. 141.
- .2 Equipment specifications as per drawings.

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**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                INSTALLATION**

- .1      Install unit equipment and remote mounted fixtures.
- .2      Direct heads.

**3.3                PROTECTION**

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

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 31 14 13 - Soil Stripping and Stockpiling.
- .2        Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2            DEFINITIONS**

- .1        Clearing: Consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris:
  - .1        Close-cut clearing: Consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
  - .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 fallen timber and surface debris.
- .2        Grubbing: Consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

**1.3            REFERENCE STANDARDS**

- .1        Canada Labour Code, Part 2, Canada Occupational Health and Safety Regulations.
- .2        Provincial Legislation - Occupational Health and Safety Act, 1990. Amended.
- .3        Canadian Environmental Protection Act, 1999 (CEPA 1999).
- .4        Provincial Legislation - Ontario Water Resources Act, 1990. Amended.
- .5        Provincial Legislation - Ontario Environmental Protection Act, 1990. Amended.
- .6        Provincial Legislation - Ontario Fish and Wildlife Conservation Act, 1997. Amended.
- .7        Provincial Legislation - Endangered Species Act, 2007. Amended.

**1.4            ADMINISTRATIVE REQUIREMENTS**

- .1        Arrange for a site meeting, before Work starts, with DCC Representative 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.
- .2        Contractor is responsible for obtaining or coordinating any permits required for clearing and grubbing works.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Prevent damage to trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utilities, and other site appurtenances which are to remain:
  - .1 Repair damaged items to approval of DCC Representative.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Soil Material for Fill:
  - .1 Excavated soil material: Free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
  - .2 Remove and store soil material for reuse.

## **Part 3 Execution**

### **3.1 CONTROLS**

- .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 areas.
  - .2 Construct, inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.2 PREPARATION**

- .1 Inspect site and verify with DCC Representative any items designated to remain.
- .2 Locate and protect utility lines: Preserve in operating condition active utilities traversing site:
  - .1 Notify DCC Representative immediately of damage to or when unknown existing utility line(s) 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.
- .4 Keep roads and walks free of dirt and debris.

### **3.3 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 DCC Representative, by cutting at height of not more than 200 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1,000 mm above ground surface.
- .3 Cut off branches overhanging area cleared as directed by DCC Representative.

### **3.4 CLOSE CUT CLEARING**

- .1 Close cut clearing to ground level to within 100 mm of ground surface.
- .2 Perform close cut clearing by hand so that existing muskeg is not damaged.
- .3 Cut off branches overhanging area cleared as directed by DCC Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by DCC Representative.

### **3.5 ISOLATED TREES**

- .1 Cut off isolated trees as indicated by DCC Representative at height of not more than 200 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.
- .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

### **3.6 UNDERBRUSH CLEARING**

- .1 Clear underbrush from areas as indicated at ground level.

### **3.7 GRUBBING**

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform to existing adjacent surface of ground.

### **3.8 REMOVAL AND DISPOSAL**

- .1 All vegetative materials shall be removed off-site at the Contractors own expense.

### **3.9 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for stripping of topsoil to approval of DCC Representative.

**3.10 CLEANING**

- .1 Proceed in accordance with cleaning subsection of Section 01 74 00 - Cleaning & Waste Management.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 35 43 - Environmental Protection.

**1.2 REFERENCES**

- .1 Provincial Legislation - Occupational Health and Safety Act, 1990. Amended.
- .2 Canadian Environmental Protection Act, 1999 (CEPA 1999).
- .3 Provincial Legislation - Ontario Environmental Protection Act, 1990. Amended.
- .4 Provincial Legislation - Ontario Water Resources Act, 1990. Amended.
- .5 Provincial Legislation - Ontario Fish and Wildlife Conservation Act, 1997. Amended.
- .6 Provincial Legislation - Endangered Species Act, 2007. Amended.

**1.3 EXISTING CONDITIONS**

- .1 Known underground and surface utility lines and buried objects are as indicated on the plans. Services shown are approximate. Contractor shall verify all utilities by completing it's own locates at the start of construction with Authorities Having Jurisdiction and with DND.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

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

**3.2 STRIPPING OF TOPSOIL**

- .1 Ensure that procedures are conducted in accordance with applicable Provincial, Federal, and Base requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation off-site.

- .5 Remove brush from targeted area by non-chemical means and dispose off-site.
- .6 Strip topsoil by scraper to depths as indicated:
  - .1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil by mechanical hoe in berms in locations as directed by DCC Representative:
  - .1 Stockpile height not to exceed 2.5 - 3 m.
- .8 Dispose of unused topsoil off-site at Contractors own expense.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

### **3.3 CLEANING**

- .1 Proceed in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**



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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1       Section 01 74 00 - Cleaning & Waste Management.
- .2       Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2               REFERENCES**

- .1       ASTM International:
  - .1       ASTM D698-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).
- .2       Canadian Environmental Protection Act, 1999 (CEPA 1999).
- .3       Provincial Legislation - Ontario Water Resources Act, 1990. Amended.
- .4       Provincial Legislation - Ontario Environmental Protection Act, 1990. Amended.
- .5       Provincial Legislation - Ontario Fish and Wildlife Conservation Act, 1997. Amended.
- .6       Provincial Legislation - Ontario Endangered Species Act, 2007. Amended.
- .7       Ontario Provincial Standards (OPS):
  - .1       OPSS MUNI 1010 - Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material.

**1.3               EXISTING CONDITIONS**

- .1       Examine subsurface investigation report which is bound into the specification Appendices.
- .2       Known underground and surface utility lines and buried objects are as indicated on the plans. Services shown are approximate. Contractor shall verify all utilities by completing it's own locates at the start of construction with Authorities Having Jurisdiction and with DND.
- .3       Refer to dewatering in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**Part 2            Products**

**2.1               MATERIALS**

- .1       Select (common) Fill: Common material from site which is free of stumps, trees, roots, organics, boulders and masonry larger than 100 mm in any dimension, contamination, and other deleterious materials as approved by the DCC Representative.

- .2 Imported Structural Fill: Granular A or Granular B Type II in accordance with OPS as approved by the DCC Representative. Gradations as follows:

- .1 Granular B Type II:

Sieve Designation	% Passing
106 mm	100
26.5 mm	50 - 100
4.75 mm	20 - 55
1.18 mm	10 - 40
0.30 mm	5 - 22
0.075 mm	0 - 10

- .2 Granular A:

Sieve Designation	% Passing
26.5 mm	100
19 mm	85 - 100
13.2 mm	65 - 90
9.5 mm	50 - 73
4.75 mm	35 - 55
1.18 mm	15 - 40
0.30 mm	5 - 22
0.075 mm	2 - 8

### Part 3 Execution

#### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading installation:
- .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 to approval of DCC Representative.

#### 3.2 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated on drawings.
- .2 Slope rough grade away from above grade structures as indicated on drawings. Slope rough grade to match the slope of finished grade.
- .3 Grade ditches to depth as required for maximum run-off as indicated on drawings.
- .4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

- .5 Compact filled and disturbed areas to Standard Proctor Maximum Dry Density (SPMDD) to ASTM D698, as noted on drawings.
- .6 Do not disturb soil within branch spread of trees or shrubs to remain.

### **3.3 TESTING**

- .1 DCC Representative may engage a third-party materials testing agency for the purposes of quality assurance to test portions of Work under this Section. This does not relieve the Contractor in completing its own quality control.
- .2 The Contractor will be responsible for its own quality control activities to ensure conformance with the contract documents. Quality assurance provided by a third-party testing agency hired by the DCC Representative does not release the Contractor of its own quality control activities. The Contractor shall hire its own third-party materials testing agency to test portions of the Work under this section. Testing frequency shall be determined by the third-party testing agency in accordance with good construction practices.
- .3 If defects are revealed during inspection and/or testing, the DCC Representative will request additional inspections and/or testing to ascertain the full degree of the defect. The Contractor shall correct the defect as directed by the DCC Representative at no additional costs and pay for costs of re-testing and re-inspection.

### **3.4 CLEANING**

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

### **3.5 PROTECTION**

- .1 Maintain access roads to prevent accumulation of construction related debris on roads during rough grading operations to the approval of the DCC Representative.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1      Section 01 35 43 - Environmental Protection.
- .2      Section 01 35 43.01 - Environmental Protection - Soil Management.
- .3      Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2                PRICE AND PAYMENT PROCEDURES**

- .1      The Contactor is not to include rock removal in their lump sum bid.
- .2      The Contractor shall provide unit rates for rock removal based on a quantities as shown below and as outlined in the unit price table included with this tender.
  - .1      Rock removal Site #1: 250 cubic meters.
  - .2      Rock removal Site #2: 150 cubic meters.
  - .3      Rock removal Site #3: 75 cubic meters.
  - .4      Rock removal Site #4: 50 cubic meters.
- .3      Payment at the unit rates shall be full compensation for all associated labour, material, equipment, removal, transportation offsite and disposal costs to complete the work.
  - .1      Measurement Procedures:
    - .1      Quantities to be derived from the Contractor's GPS survey of the existing top of rock elevation prior to rock removal and another Contractor GPS survey following rock removals to determine the rock removal volume. Surveys and rock quantities are to be reviewed on a regular basis with the DCC Representative prior to, during, and after rock removals.

**1.3                DEFINITIONS**

- .1      Rock: Any solid material in excess of 1.0 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
- .2      Peak Particle Velocity (PPV): Maximum speed or velocity reached by a particle in a medium, such as the ground, as a result of a 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.
- .3      Line Drilling: the method of drilling and broaching for the primary cut. In this method, deep holes are drilled close together in a straight line by means of a reciprocating drill mounted on a bar.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

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

## **1.5 QUALITY ASSURANCE**

- .1 Vibration Control:
  - .1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.
  - .2 Complete pre-construction survey and documentation in accordance with Section 01 71 00 - Examination and Control.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 ROCK REMOVAL**

- .1 Perform excavation in accordance with Section 01 35 43 - Environmental Protection and Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Co-ordinate this Section with Section 01 70 12 - Safety Requirements.
- .3 Remove rock to alignments, profiles, and cross sections as required to complete the work.
- .4 Explosive blasting is not permitted.
- .5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak and avoid damage to adjacent structures.
- .6 Excavate rock to horizontal surfaces with slope not to exceed the slope within the drawings.
- .7 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
- .8 Excavate trenches to lines and grades to minimum of 150 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
- .9 Perform line drilling, especially in areas close to existing foundations to minimize over-excavation.
- .10 Cut trenches to widths as indicated.
- .11 Remove boulders and fragments which may slide or roll into excavated areas.
- .12 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 Rock Disposal:
  - .1 Dispose of surplus removed rock off site in accordance with Section 01 35 43 - Environmental Protection and Section 01 35 43.01 Environmental Protection - Soil Management.

- .2 Do not dispose of removed rock into landfill. Send material to appropriate quarry.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

### **3.3 PROTECTION**

- .1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 01 35 43 - Environmental Protection.
- .3    Section 01 45 00 - Quality Control.
- .4    Section 01 74 00 - Cleaning & Waste Management.
- .5    Section 31 14 13 - Soil Stripping and Stockpiling.
- .6    Section 31 22 13 - Rough Grading.
- .7    Section 31 32 19.16 - Geotextile Soil Stabilization
- .8    Section 33 14 16 - Site Water Utility Distribution Piping
- .9    Section 33 42 13 - Pipe Culverts.

**1.2                REFERENCES**

- .1    ASTM International (ASTM):
  - .1    ASTM C117- 17 , Standard Test Method for Material Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2    ASTM C136/C136M- 19 , Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3    ASTM D422-63 2002 , Standard Test Method for Particle-Size Analysis of Soils.
  - .4    ASTM D698- 12 , Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .5    ASTM D4318- 17e1 , Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2    Canadian General Standards Board (CGSB):
  - .1    CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3    Canadian Environmental Protection Act, 1999 (CEPA 1999).
- .4    Provincial Legislation - Ontario Environmental Protection Act, 1990. Amended.
- .5    Provincial Legislation - Ontario Fish and Wildlife Conservation Act, 1997. Amended.
- .6    Provincial Legislation - Ontario Endangered Species Act, 2007. Amended.
- .7    Provincial Legislation - Ontario Water Resources Act, 1990. Amended.
- .8    Canada Occupational Health and Safety Regulations (1986). Amended.
- .9    Provincial Legislation - Occupational Health and Safety Act, 1990. Amended.
- .10   Ontario Provincial Standards (OPS):
  - .1    OPSS MUNI 1010 - Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material.

### 1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation:
  - .1 Rock: solid material in excess of 1.0 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: non-contaminated material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.2.
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
    - .3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve

### 1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control.



- .3 Submittals:
  - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
  - .2 Submit for review by DCC Representative proposed dewatering methods.
  - .3 Submit to DCC Representative written notice at least 10 days prior to excavation work.
  - .4 Submit to DCC Representative written notice when bottom of excavation is reached.
  - .5 Submit to DCC Representative testing results as described in PART 3 of this Section.
- .4 Preconstruction Submittals:
  - .1 Submit construction equipment list for major equipment to be used in this Section prior to start of Work.
  - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field and location plan of relocated and abandoned services, as required.

## **1.5 QUALITY ASSURANCE**

- .1 Engage services of qualified professional Engineer who is licensed in the Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing, and underpinning if required for Work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer licensed in the Province of Ontario, Canada.
- .3 Keep design and supporting data on site.

## **1.6 EXISTING CONDITIONS**

- .1 Examine soil report which is bound into the specification Appendices.
- .2 Buried services:
  - .1 Size, depth and location of existing utilities and structures indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .2 Known underground and surface utility lines and buried objects are as indicated on site plan. Services shown are approximate. Contractor shall verify all utilities at the start of construction with authorities having jurisdiction and with DND.
  - .3 Prior to beginning excavation Work, notify DCC Representative or Authorities Having Jurisdiction, to clearly mark such locations to prevent disturbance during Work. For a Dig Permit, allow at a minimum:
    - .1 10 working days prior to excavation to allow DND to locate and mark utilities and cables.
  - .4 Confirm locations of buried utilities by hand digging or careful test excavations using hydrovac in presence of DCC Representative. Hand dig all cables 1 meter either side of cable prior to machine excavation.

- .5 Maintain and protect from damage, water, sewer, gas, electric, telephone, cables, monitoring wells, and other utilities and structures encountered.
- .6 Where utility lines or structures exist in area of excavation, obtain direction of DCC Representative before removing or otherwise disturbing utilities or structures.
- .7 Record location of maintained, re-routed, and abandoned underground lines.
- .3 Existing buildings and surface features:
  - .1 Conduct, with DCC Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks, and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by DCC Representative.

## Part 2 Products

### 2.1 MATERIALS

- .1 Select (common) Fill: Common material from site which is free of stumps, trees, roots, organics, boulders and masonry larger than 100 mm in any dimension, contamination, and other deleterious materials as approved by the DCC Representative.
- .2 Imported Structural Fill: Clear stone, Granular A or Granular B Type II in accordance with OPS as approved by the DCC Representative. Gradations as follows:
  - .1 Clear Stone: 19 mm nominal diameter:

Sieve Size	% Passing
26.5 mm	100
19.0 mm	90-100
9.5 mm	0-55
4.75 mm	0-10
0.075 mm	0-2.0

- .2 Granular A:

Sieve Designation	% Passing
26.5 mm	100
19 mm	85 - 100
13.2 mm	65 - 90
9.5 mm	50 -73
4.75 mm	35 - 55
1.18 mm	15 - 40
0.30 mm	5 - 22
0.075 mm	2 - 8

.3 Granular B Type II:

Sieve Designation	% Passing
106 mm	100
26.5 mm	50 - 100
4.75 mm	20 - 55
1.18 mm	10 - 40
0.30 mm	5 - 22
0.075 mm	0 - 10

.3 Pipe and Structure Bedding: Granular A as described above.

.4 Electrical Utility Bedding: Sand consisting of fine granular material composed of hard, strong, durable mineral particles which are free of injurious amounts of saline, alkaline, organic, or other deleterious materials, and graded as follows:

Sieve Designation	% Passing
5.0 mm	95 - 100
2.5 mm	80 - 100
1.25 mm	50 - 85
630 µm	25 - 60
280 µm	10 - 30
160 µm	0 - 15
75 µm	0 - 5

.5 Unshrinkable fill: proportioned and mixed to provide:

- .1 Maximum compressive strength of 0.4 MPa at 28 days.
- .2 Maximum cement content of 25 kg/m<sup>3</sup>.
- .3 Minimum strength of 0.07 MPa at 24 h.
- .4 Concrete aggregates: To CSA-A23.1/A23.2.
- .5 Cement: Type GU.
- .6 Slump: 160 to 200 mm.

.6 Marking Tape: Color coded heavy gauge polyethylene, 150 mm wide indicating the service type buried below.

.7 Geotextile soil stabilization: To Section 31 32 19.16 - Geotextile Soil Stabilization.

.8 Rigid Board Insulation: Extruded polystyrene (XPS) rigid insulation board to CAN/ULC S701, Type 4 with the following properties:

- .1 Flexural strength: 413 kPa to ASTM C203.
- .2 Compressive strength: 275 kPa to ASTM D1621.
- .3 Thermal: RSI 0.88 m<sup>2</sup> K/W per 25 mm.
- .4 Water absorption: 0.1% to ASTM C272.

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**Part 3 Execution**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soils erosion and discharge of soil-bearing water runoff or airborne dust to adjacent areas.
- .2 Construct, inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2 SITE PREPARATION**

- .1 Remove obstructions, ice, and snow from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

**3.3 PREPARATION/PROTECTION**

- .1 Keep excavations clean, free of standing water and loose soil.
- .2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to DCC Representative approval.
- .3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .4 Protect buried services that are required to remain undisturbed.

**3.4 STRIPPING OF TOPSOIL AND STOCKPILING**

- .1 Do topsoil stripping and stockpiling in accordance with Section 31 14 13 – Soil Stripping and Stockpiling.

**3.5 COFFERDAMS, SHORING, BRACING, AND UNDERPINNING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with the Provincial Health and Safety Act.
- .2 Construct temporary Works to depths, heights, and locations as approved by DCC Representative.
- .3 During backfill operation:
  - .1 Unless otherwise indicated or directed by DCC Representative, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.

- .5 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring, and bracing.
  - .2 Remove excess materials from site.

### **3.6 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for DCC Representative's details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur:
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction:
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Ensure no sediment laden water reaches sewers, watercourses, wetlands, or drainage areas. If necessary, provide flocculation tanks, settling basins, dewatering tubes, or other treatment methods and facilities to remove suspended solids or other materials before discharging from site as approved by the DCC Representative.

### **3.7 ROCK BREAKING**

- .1 The Contractor will have to break and excavate rock to achieve the final sub-grades.
- .2 See Section 31 23 16.26 - Rock Removal for details.

### **3.8 EXCAVATION**

- .1 Advise DCC Representative at least 10 days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations, and dimensions as indicated.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain:
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 For trench excavation do not excavate more than 30 m of trench in advance of installation operations. All excavations shall be filled at end of work day prior to leaving site.
- .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by DCC Representative.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material in approved location.
- .9 Do not obstruct flow of surface drainage or natural watercourses.

- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft, or organic matter.
- .11 Notify DCC Representative when bottom of excavation is reached.
- .12 Obtain DCC Representative approval of completed excavation.
- .13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by DCC Representative.
- .14 Correct unauthorized over-excavation as follows:
  - .1 Fill under footings, pads, and roadway areas with structural fill compacted not less than 100 % of SPMDD to within the design subgrade.
  - .2 Fill under other areas with common or imported fill compacted not less than 95% SPMDD to within the design subgrade.
- .15 Hand trim, make firm, and remove loose material and debris from excavations:
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

### **3.9 FILL TYPES AND COMPACTION**

- .1 Use types of fill and compact as indicated on drawings.

### **3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Hand place material in uniform layers not exceeding 150 mm compacted thickness as indicated on drawings.
- .2 Place bedding and surround material in unfrozen condition.

### **3.11 WATERPROOFING AND INSULATION**

- .1 Install waterproofing membrane as indicated and in accordance with manufacturer instructions.
- .2 Install rigid board insulation as indicated and in accordance with manufacturer instructions.

### **3.12 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of the following:
  - .1 DCC Representative has inspected and approved installations.
  - .2 DCC Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
  - .4 Removal of concrete formwork.
  - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water, and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow, or debris.
- .4 Do not use backfill which is contaminated.

- .5 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Backfilling around installations:
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 300 mm.
- .7 Place unshrinkable fill in areas as indicated.
- .8 Consolidate and level unshrinkable fill with internal vibrators.

### **3.13 TESTING**

- .1 DCC Representative may engage a third-party materials testing agency for the purposes of quality assurance to test portions of Work under this Section. This does not relieve the Contractor in completing its own quality control.
- .2 The Contractor will be responsible for its own quality control activities to ensure conformance with the contract documents. Quality assurance provided by a third-party testing agency hired by the DCC Representative does not release the Contractor of its own quality control activities. The Contractor shall hire its own third-party materials testing agency to test portions of the Work under this Section. Testing frequency shall be determined by the third-party testing agency in accordance with good construction practices.
- .3 If defects are revealed during inspection and/or testing, the DCC Representative will request additional inspections and/or testing to ascertain the full degree of the defect. The Contractor shall correct the defect as directed by the DCC Representative at no additional costs and pay for costs of re-testing and re-inspection.

### **3.14 RESTORATION**

- .1 Replace topsoil as indicated.
- .2 Reinstate lawns to elevation which existed before excavation.
- .3 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure, and 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 hours.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2            REFERENCE STANDARDS**

- .1    Ontario Provincial Standards (OPS):
  - .1    OPSS 1860 - Material Specification for Geotextiles.
- .2    ASTM International:
  - .1    ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2    ASTM D3786-18, Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.
  - .3    ASTM D4355-21, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus.
  - .4    ASTM D4491-22, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .5    ASTM D4533-15, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
  - .6    ASTM D4632-15, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - .7    ASTM D4751-21, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  - .8    ASTM D4833-20, Standard Test Method for Index Puncture Resistance of Geomembranes and related Products.
  - .9    ASTM D5261-18, Standard Test Method for Mearing Mass or Unit Area of Geotextiles.
- .3    CSA Group:
  - .1    CSA G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

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



- .3 Test and Evaluation Reports:
  - .1 Submit copies of mill test data and certificate at least 4 weeks prior to start of Work.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Store and protect geotextiles from direct sunlight and UV rays.
  - .3 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIAL**

- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls:
  - .1 Non-woven geotextile in accordance with OPSS 1860:
    - .1 Grab Tensile Strength 450 N to CAN/CGSB 147.1 No. 7.3.
    - .2 Mullen (Burst) Strength 1.4 MPa to CAN/CGSB 4.2 No. 11.1.
    - .3 Tear Strength 210 N to CAN/CGSB 4.2 No. 12.2.
    - .4 Filtration Opening Size (FOS) 50-150 micro-m to CAN/CGSB 148.1 No. 10.2.
    - .5 Permeability (K) > 0.20 to CAN/CGSB 4.2 No. 11.1.
    - .6 Elongation at Break 70% to 100% to CAN/CGSB 14.8 No. 7.3.
- .2 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to ASTM A123/A123M.
- .3 Factory seams: sewn in accordance with manufacturer's recommendations.
- .4 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

### **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 geotextile material 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 to approval of DCC Representative.

### **3.2 INSTALLATION**

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner, and locations indicated.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Join successive strips of geotextile by sewing.
- .6 Pin successive strips of geotextile with securing pins.
- .7 Protect installed geotextile material from displacement, damage, or deterioration before, during, and after placement of material layers.
- .8 After installation, cover with overlying layer within 4 hours of placement.
- .9 Replace damaged or deteriorated geotextile to approval of DCC Representative.
- .10 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **3.3 CLEANING**

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

### **3.4 PROTECTION**

- .1 Vehicular traffic not permitted directly on geotextile.
- .2 Do not overload soil or aggregate covering on geotextile.

**END OF SECTION**

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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1            Section 31 32 19.16 - Geotextile Soil Stabilization.

**1.2               REFERENCE STANDARDS**

- .1            Ontario Provincial Standards (OPS):
  - .1            OPSS 1004 - Material Specifications for Aggregates - Miscellaneous.

**Part 2            Products**

**2.1               STONE**

- .1            Hard, durable quarry stone, free from seams, cracks, or other structural defects to meet following size distribution for use intended:
  - .1            R-10 rip-rap in accordance with OPSS 1004, graded as follows:
    - .1            15 kg: 100%.
    - .2            10 kg: 70 - 90%.
    - .3            5 kg: 40 - 55%.
    - .4            0.5 kg: 0 - 15%

**2.2               GEOTEXTILE FILTER**

- .1            Geotextile soil stabilization: in accordance with Section 31 32 19.16 - Geotextile Soil Stabilization.

**Part 3            Execution**

**3.1               PLACING**

- .1            Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .2            Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3            Place geotextile on prepared surface in accordance with Section 31 32 19.16 - Geotextile Soil Stabilization and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .4            Place rip-rap to thickness and details as indicated.
- .5            Place stones in manner approved by DCC Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6            Hand placing:
  - .1            Use larger stones for lower courses and as headers for subsequent courses.
  - .2            Stagger vertical joints and fill voids with rock spalls or cobbles.

- .3 Finish surface evenly, free of large openings, and neat in appearance.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 22 13 - Rough Grading.

**1.2 REFERENCES**

- .1 ASTM International (ASTM):
  - .1 ASTM D698- 12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2 Ontario Provincial Standards (OPS):
  - .1 OPSS MUNI 1010 - Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Granular B Type II in accordance with OPS:
  - .1 Graded as follows:

Sieve Designation	% Passing
106 mm	100
26.5 mm	50 - 100
4.75 mm	20 - 55
1.18 mm	10 - 40
0.3 mm	5 - 22
0.075 mm	0 - 10

**Part 3 Execution**

**3.1 PLACING**

- .1 Place granular sub-base after subgrade is inspected and approved by DCC Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Remove and replace portion of layer in which material has become segregated during spreading.

### **3.2 COMPACTION**

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 100% SPMDD.
- .3 Shape and roll alternately to obtain smooth, even, and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by DCC Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### **3.3 PROOF ROLLING**

- .1 For proof rolling use standard roller of 45,400 kg gross mass with four pneumatic tires.
- .2 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .3 Where proof rolling reveals areas of defective subgrade:
  - .1 Remove sub-base and subgrade material to depth and extent as directed by DCC Representative.
  - .2 Backfill excavated subgrade with sub-base material and compact in accordance with this Section.
  - .3 Replace sub-base material and compact.
- .4 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this Section at no extra cost.

### **3.4 TESTING**

- .1 DCC Representative may engage a third-party materials testing agency for the purposes of quality assurance to test portions of Work under this Section. This does not relieve the Contractor in completing its own quality control.
- .2 The Contractor will be responsible for its own quality control activities to ensure conformance with the contract documents. Quality assurance provided by a third-party testing agency hired by the DCC Representative does not release the Contractor of its own quality control activities. The Contractor shall hire its own third-party materials testing agency to test portions of the Work under this Section. Testing frequency shall be determined by the third-party testing agency in accordance with good construction practices.
- .3 If defects are revealed during inspection and/or testing, the DCC Representative will request additional inspections and/or testing to ascertain the full degree of the defect. The

Contractor shall correct the defect as directed by the DCC Representative at no additional costs and pay for costs of re-testing and re-inspection.

### **3.5 CLEANING**

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

### **3.6 SITE TOLERANCES**

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

### **3.7 PROTECTION**

- .1 Maintain finished sub-base in condition conforming to this Section until succeeding base is constructed, or until granular sub-base is accepted by DCC Representative.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 32 11 16.01 - Granular Sub-Base.

### **1.2 REFERENCES**

- .1 ASTM International (ASTM):
  - .1 ASTM D698- 12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2 Ontario Provincial Standards (OPS):
  - .1 OPSS MUNI 1010 - Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Granular A in accordance with OPS:
  - .1 Graded as follows:

<b>Sieve Designation</b>	<b>% Passing</b>
26.5 mm	100
19 mm	85 - 100
13.2 mm	65 - 90
9.5 mm	50 - 73
4.75 mm	35 - 55
1.18 mm	15 - 40
0.30 mm	5 - 22
0.075 mm	2 - 8

## **Part 3 Execution**

### **3.1 PLACEMENT AND INSTALLATION**

- .1 Place granular base after subgrade or sub-base surface is inspected and approved in writing by DCC Representative.
- .2 Placing:
  - .1 Construct granular base to depth and grade in areas indicated.
  - .2 Ensure no frozen material is placed.
  - .3 Place material only on clean unfrozen surface, free from snow and ice.
  - .4 Begin spreading base material on crown line or on high side of one-way slope.
  - .5 Place material using methods which do not lead to segregation or degradation of aggregate.



- .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
  - .1 Ensure compaction equipment is capable of obtaining required material densities.
- .4 Compacting:
  - .1 Compact to density not less than 100% SPMDD.
  - .2 Shape and roll alternately to obtain smooth, even, and uniformly compacted base.
  - .3 Apply water as necessary during compacting to obtain specified density.
  - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by DCC Representative.
  - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof rolling:
  - .1 For proof rolling use standard roller of 45,400 kg gross mass with four pneumatic tires.
  - .2 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
  - .3 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 Section 32 11 16.01 - Granular Sub-Base.
    - .3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-Base.
    - .4 Replace base material and compact in accordance with this Section.
  - .4 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 32 11 16.01 - Granular Sub-Base and this Section at no extra cost.

### 3.2 TESTING

- .1 DCC Representative may engage a third-party materials testing agency for the purposes of quality assurance to test portions of Work under this Section. This does not relieve the Contractor in completing its own quality control.

- .2 The Contractor will be responsible for its own quality control activities to ensure conformance with the contract documents. Quality assurance provided by a third-party testing agency hired by the DCC Representative does not release the Contractor of its own quality control activities. The Contractor shall hire its own third-party materials testing agency to test portions of the Work under this Section. Testing frequency shall be determined by the third-party testing agency in accordance with good construction practices.
- .3 If defects are revealed during inspection and/or testing, the DCC Representative will request additional inspections and/or testing to ascertain the full degree of the defect. The Contractor shall correct the defect as directed by the DCC Representative at no additional costs and pay for costs of re-testing and re-inspection.

### **3.3 SITE TOLERANCES**

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

### **3.4 CLEANING**

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

### **3.5 PROTECTION**

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by DCC Representative.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 32 11 16.01 - Granular Sub-Base.
- .2    Section 32 11 23 - Aggregate Base Courses.

**1.2            REFERENCE STANDARDS**

- .1    American Association of State Highway and Transportation Officials (AASHTO):
  - .1    AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
  - .2    AASHTO R29-08, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
  - .3    AASHTO T245-97 (2008), Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
- .2    Asphalt Institute (AI):
  - .1    AI MS-2-1994, Mix Design Methods for Asphalt Concrete and Other Hot-Mixes.
- .3    ASTM International:
  - .1    ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
  - .2    ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .4    Ontario Provincial Standards (OPS):
  - .1    OPSS MUNI 310 - Construction Specification for Hot Mix Asphalt.
  - .2    OPSS MUNI 1003 - Aggregates, Hot Mix Asphalt.
  - .3    OPSS MUNI 1010 - Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material.
  - .4    OPSS MUNI 1101 - Performance Graded Asphalt Cement.
  - .5    OPSS MUNI 1150 - Material Specification for Hot Mix Asphalt.
- .5    The Master Painters Institute (MPI):
  - .1    Architectural Painting Specification Manual - 2019:
    - .1    MPI #32, Traffic Marking Paint, Alkyd.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

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

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**Part 2 Products**

**2.1 MATERIALS**

- .1 Tack Coat: Anionic emulsified asphalt to CAN/CGSB 16.2, grade SS-1.
- .2 Granular B Type II in accordance with OPS and Section 32 11 16.01 - Granular Sub-Base.
- .3 Granular A in accordance with OPS and Section 32 11 23 - Aggregate Base Courses.
- .4 HL-3 asphalt in accordance with OPS requirements.
- .5 HL-8 asphalt in accordance with OPS requirements.
- .6 Asphalt binder PG 58-28.

**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 asphalt paving 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 DCC Representative.

**3.2 ACCESS ROADS AND UTILITY CUT REINSTATEMENTS**

- .1 SS-1 tack coat.
- .2 Sub-base material: 300 mm Granular B Type II compacted to 100% SPMDD to ASTM D698 in two lifts.
- .3 Base material: 150 mm Granular A compacted to 100% SPMDD to ASTM D698 in one lift.
- .4 Asphalt base course: 50 mm HL-8 compacted to 92% Theoretical Maximum Relative Specific Gravity (TMSG) to AASHTO T209 in one lift.
- .5 Asphalt top course: 50 mm HL-3 compacted to 92% Theoretical Maximum Relative Specific Gravity (TMSG) to AASHTO T209 in one lift.

**3.3 PAVEMENT CONSTRUCTION**

- .1 Transport materials in accordance with OPS requirements.
- .2 Sawcut existing asphalt edges and clean surfaces of loose and foreign materials.
- .3 Apply tack coat.
- .4 Place materials and compact as noted in Section 3.2.
- .5 Place asphalt mix only when air temperature is above 5 °C.

- .6 Provide suitable compaction equipment as approved by the DCC Representative needed to meet all specified densities for granular and asphalt materials.
- .7 Finished asphalt surface to be within +/- 5 mm of design elevation but not uniformly high or low.

### **3.4 TESTING**

- .1 DCC Representative may engage a third-party materials testing agency for the purposes of quality assurance to test portions of Work under this Section. This does not relieve the Contractor in completing its own quality control.
- .2 The Contractor will be responsible for its own quality control activities to ensure conformance with the contract documents. Quality assurance provided by a third-party testing agency hired by the DCC Representative does not release the Contractor of its own quality control activities. The Contractor shall hire its own third-party materials testing agency to test portions of the Work under this Section. Testing frequency shall be determined by the third-party testing agency in accordance with good construction practices.
- .3 If defects are revealed during inspection and/or testing, the DCC Representative will request additional inspections and/or testing to ascertain the full degree of the defect. The Contractor shall correct the defect as directed by the DCC Representative at no additional costs and pay for costs of re-testing and re-inspection.

### **3.5 TRAFFIC MARKINGS**

- .1 Paint parking space divisions and other pavement markings in accordance with manufacturers recommendations and to match existing markings.
- .2 Use paint thinner in accordance with manufacturer's requirements.

### **3.6 CLEANING**

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

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2 REFERENCE STANDARDS**

- .1 ASTM International:
- .1 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .2 ASTM C 309 03, Liquid Membrane Forming Compounds for Curing Concrete.
  - .3 ASTM D1751, Standard Specification For Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .4 ASTM D698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D260-86 (2001), Standard Specification for Boiled Linseed Oil.
- .2 CSA Group:
- .1 CSA-A23.1-14/A23.2-, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete, Including Update No. 1, 2015.
  - .2 CSA B651-2012 Accessible Design for the Built Environment.
- .3 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-3.3-99 (March 2004), Kerosene, Amend. No. 1, National Standard of Canada.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
- .1 Divert unused soil amendments from landfill to official hazardous material collections site approved by DCC Representative.
  - .2 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground, or in locations where it will pose health or environmental hazard.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Concrete mixes and materials: to Section 03 30 00.09 - Cast-in-Place Concrete - Short Form.

- .2 Joint filler: 20 mm preformed non-extruding resilient bituminous type.
- .3 Granular base: as indicated on drawings and in accordance with Section 32 11 23 - Aggregate Base Courses.
- .4 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .5 Fill material: As indicated on drawings and in accordance with Section 31 22 13 - Rough Grading.
- .6 Boiled linseed oil: to ASTM D260.
- .7 Kerosene: to CAN/CGSB-3.3.

### **Part 3 Execution**

#### **3.1 GRADE PREPARATION**

- .1 Do grade preparation work in accordance with Section 31 22 13 - Rough Grading and Section 31 23 33.01 - Excavating, Trenching and Backfilling.

#### **3.2 GRANULAR BASE**

- .1 Obtain DCC Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated on drawings.
- .3 Compact granular base in maximum 150 mm layers to minimum 100% of maximum density to ASTM D698.

#### **3.3 CONCRETE**

- .1 Obtain DCC Representative's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Provide edging as indicated with 10 mm radius edging tool.

#### **3.4 TOLERANCES**

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

#### **3.5 CONTROL JOINTS**

- .1 Sawcut transverse control joints after floating, when concrete is stiff, but still plastic, before uncontrolled shrinkage takes place 4 to 24 hours after placement.

#### **3.6 ISOLATION JOINTS**

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints as indicated on drawings.
- .3 Seal isolation joints with sealant approved by DCC Representative.

### **3.7 CURING**

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for minimum 1 day after placing, or sealing moisture in by curing compound as directed by DCC Representative.
- .2 Where burlap used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

### **3.8 BACKFILL**

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations as indicated on drawings.

### **3.9 LINSEED OIL TREATMENT**

- .1 Apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters, after concrete has cured for specified curing time and when surface of concrete clean and dry.
- .2 Linseed oil mixture to consist of 50% boiled linseed oil and 50% mineral spirits by volume.
- .3 Apply treatment when air temperature above 10 °C.
- .4 Apply first coat at 135 mL/m<sup>2</sup>.
- .5 Apply second coat at 90 mL/m<sup>2</sup> when first coat has dried.

### **3.10 CLEANING**

- .1 Proceed in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**



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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 35 43 - Environmental Protection.
- .2 Section 01 74 00 - Cleaning & Waste Management.
- .3 Section 31 14 13 - Soil Stripping and Stockpiling.

**1.2 REFERENCES**

- .1 Agriculture and Agri-Food Canada:
  - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment (CCME):
  - .1 PN1340- 2005 , Guidelines for Compost Quality.
- .3 Canadian Environmental Protection Act, 1999 (CEPA 1999).
- .4 Provincial Legislation - Ontario Occupational Health and Safety Act, 1990. Amended.

**1.3 DEFINITIONS**

- .1 Compost:
  - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
  - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss on Ignition (LOI) test.
  - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 50) and contain no toxic or growth inhibiting contaminants.
  - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category A.

**Part 2 Products**

**2.1 TOPSOIL**

- .1 In accordance with Section 01 35 43.01 - Environmental Protection - Soil Management.

**2.2 SOIL AMENDMENTS**

- .1 In accordance with Section 01 35 43.01 - Environmental Protection - Soil Management.

**Part 3 Execution**

**3.1 PREPARATION OF EXISTING GRADE**

- .1 Verify that grades are correct:
  - .1 If discrepancies occur, notify DCC Representative and do not start work until instructed by DCC Representative.
- .2 Grade soil, eliminate uneven areas and low spots, and ensure positive drainage.

- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter, and other deleterious materials:
  - .1 Remove soil contaminated with calcium chloride, toxic materials, and petroleum products.
  - .2 Remove debris which protrudes more than 75 mm above surface.
  - .3 Dispose of contaminated soil at an approved facility and provide manifests to the DCC Representative.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 150 mm:
  - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### **3.2 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil after DCC Representative has accepted subgrade.
- .2 The Contractor shall roll the topsoil with a 900 mm wide 50 kg roller to create a smooth, uniform, compacted (firm against footprints) soil base with a fine loose texture.
- .3 The Contractor shall grade and trim the topsoil to the lines, levels, profiles, contours, and elevations shown on the Drawings or as directed by the DCC Representative.
- .4 Spread topsoil only on dry, unfrozen subgrade in uniform layers not exceeding 150 mm.
- .5 Spread topsoil to following minimum depths after settlement:
  - .1 150 mm for seeded areas.
- .6 Manually spread topsoil/planting soil around trees, shrubs, and obstacles.

### **3.3 FINISH GRADING**

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage:
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by DCC Representative:
  - .1 Leave surfaces smooth, uniform, and firm against deep footprinting.
- .3 The finished surface shall be level and no more than 10 mm below adjacent concrete/asphalt roadways, driveways, walkways, curbs, or headers. Under no circumstances shall topsoil be allowed to remain higher than any adjacent finished surface.

### **3.4 ACCEPTANCE**

- .1 DCC Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil, and finish grading.

### **3.5 CLEANING**

- .1 Proceed with cleaning in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Leave Work area organized and tidy at end of each day.

- .2 Upon completion remove surplus materials, rubbish, tools, and equipment:
  - .1 Clean and reinstate areas affected by Work.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 43 - Environmental Protection.
- .3 Section 01 74 00 - Cleaning & Waste Management.
- .4 Section 32 91 19.13 - Topsoil Placement and Grading.

**1.2 SCHEDULING**

- .1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions, and warranty requirements.
- .2 Scheduling:
  - .1 Schedule hydraulic seeding to coincide with preparation of soil surface.

**1.3 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 in accordance with manufacturer's recommendations in clean, dry, and well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**1.4 WARRANTY**

- .1 For seeding, 12 months warranty period is extended to 1 full growing season.
- .2 End-of-warranty inspection will be conducted by DCC Representative.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Seed: "Playground Mix" in accordance with Government of Canada Seeds Act and Regulations:
  - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations":
    - .1 Mixture composition:
      - .1 28% Creep Red Fescue.
      - .2 25% Annual Ryegrass.

- .3 20% Tall Fescue.
- .4 10% Timothy.
- .5 10% Turf Type Perennial Ryegrass.
- .6 5% Kentucky.
- .7 2% White Clover.
- .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%.
- .3 Tackifier: water dilutable, liquid dispersion.
- .4 Water: free of impurities that would inhibit germination and growth.
- .5 Fertilizer:
  - .1 To Canada "Fertilizers Act" and Regulations.
  - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

### **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 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 approved by 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 prior to fine grading, during establishment and warranty period in accordance with manufacturer's recommendations. Fertilizing program shall be submitted to and approved by the DCC Representative.

### **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 shall be applied to surface in accordance with manufacturer's instructions.
- .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 or previous applications 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 00 – Cleaning & Waste Management:
  - .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.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 – Cleaning & Waste Management.

### **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 Perform following operations from time of seed application until acceptance by DCC Representative.
- .2 Grass Mixture:
  - .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 by DCC Representative.
  - .3 Fertilize seeded areas after 10 weeks after germination provided plants have mature true leaves in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles. Fertilizer shall not be applied in areas within 30 m of a watercourse unless approved by the DCC Representative.
  - .4 Control weeds by mechanical or chemical 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 Seeded areas are free of rutted, eroded, bare, or dead spots.
  - .2 Areas have been mown at least twice.
  - .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.

### **3.11 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Repair and reseed dead or bare spots to satisfaction of DCC Representative.
  - .2 Mow areas seeded, remove clippings that will smother grassed areas, as directed by DCC Representative.
  - .3 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water well.

**END OF SECTION**



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**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for the plant material, accessories, mulch, planting, tree support, mulching, and maintenance.
- .2 Related Sections:
  - .1 Section 01 35 43 - Environmental Protection.
  - .2 Section 01 35 43.01 - Environmental Protection- Soil Management.

**1.2 REFERENCES**

- .1 Canadian Nursery Landscape Association (CNLA):
  - .1 Canadian Standards for Nursery Stock-2001.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data for:
  - .1 Trees.
  - .2 Guying assembly including clamps, collar, guying wire, anchors, and wire tightener.
  - .3 Mulch.

**1.4 STORAGE AND PROTECTION**

- .1 Protect plant material from frost, excessive heat, wind, and sun during delivery.
- .2 Immediately store and protect plant material which will not be immediately installed after arrival at site.
- .3 Protect plant material from damage during transportation:
  - .1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
  - .2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
  - .3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
  - .4 Protect stored plant material from frost, wind, and sun, and as follows:
    - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in topsoil and watering to full depth of root zone.
    - .2 For pots and containers, maintain moisture level in containers.
    - .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

- .4 Waste Management and Disposal:
  - .1 Dispose of unused fertilizer at official hazardous material collection site approved by DCC Representative.
  - .2 Dispose of unused anti-desiccant at official hazardous material collections site approved by DCC Representative.
  - .3 Divert unused wood and mulch materials from landfill to recycling facility approved by DCC Representative.

## **1.5 WARRANTY**

- .1 Provide 12 month warranty.

## **Part 2 Products**

### **2.1 PLANT MATERIAL**

- .1 Plant material: free of disease, insects, defects, or injuries and structurally sound with strong fibrous root system.
- .2 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.
- .3 For bidding purposes assume two (2) Red Maples and fourteen (14) White Spruce will be planted between Sites 1, 2, and 3. Exact locations will be determined with DCC Representative.

### **2.2 WATER**

- .1 Free of impurities that would inhibit plant growth.

### **2.3 STAKES**

- .1 T-bar and steel.

### **2.4 WIRE TIGHTENER**

- .1 Galvanized steel.

### **2.5 GUYING WIRE**

- .1 Steel cable.

### **2.6 CLAMPS**

- .1 U-bolt: galvanized, 13 mm diameter, c/w curved retaining bar and hex nuts.

### **2.7 GUYING COLLAR**

- .1 Tube: plastic, 13 mm diameter, nylon reinforced.

### **2.8 TRUNK PROTECTION**

- .1 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 x 25 mm mesh and fastener.

- .2 Plastic: perforated spiralled strip.
- .3 Burlap: clean, minimum 2.5 kg/m<sup>2</sup> mass and 150 mm wide, and twine fastener.
- .4 Tar impregnated crepe paper and twine fastener.

## **2.9 MULCH**

- .1 Bark chip: varying in size from 25 to 50 mm in diameter, from bark of coniferous trees.
- .2 Wood chip: varying in size from 50 to 75 mm and 5 to 20 mm thick, free of bark, small branches, and leaves.
- .3 Shredded wood: varying in size from 25 to 125 mm in length, from coniferous trees.
- .4 Synthetic or inorganic mulch.

## **2.10 FERTILIZER**

- .1 Synthetic commercial type.

## **2.11 ANTI-DESICCANT**

- .1 Wax-like emulsion.

## **2.12 SOURCE QUALITY**

- .1 Obtain approval from DCC Representative of plant material prior to planting.
- .2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial, or Territorial regulations.

# **Part 3 Execution**

## **3.1 EXCAVATION AND PLANTING BEDS**

- .1 For individual planting holes:
  - .1 Stake out location and obtain approval from DCC Representative prior to excavating.

## **3.2 PLANTING**

- .1 For bare root stock, place 50 mm backfill soil in bottom of hole.
- .2 Plant trees and shrubs with roots placed straight out in hole.
- .3 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.
- .4 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
- .5 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads, and walks.
- .6 For trees and shrubs:
  - .1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.

- .7 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets. Water plant material thoroughly.
- .8 After soil settlement has occurred, fill with soil to finish grade.
- .9 Dispose of burlap, wire, and container material off site.

### 3.3 TRUNK

- .1 Install trunk protection on deciduous trees.
- .2 Install trunk protection prior to installation of tree supports when used.

### 3.4 TREE SUPPORTS

- .1 Install tree supports as indicated.
- .2 Use single stake tree support for deciduous trees less than 3 m and evergreens less than 2 m:
  - .1 Place stake on prevailing wind side and 150 mm from trunk.
  - .2 Drive stake minimum 150 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical, and unsplit.
  - .3 Install 150 mm long guying collar 1,500 mm above grade.
  - .4 Thread Type 1 guying wire through guying collar tube. Twist wire to form collar and secure firmly to stake. Cut off excess wire.
- .3 Use 3 guy wires and anchors for deciduous trees greater than 3 m and evergreens greater than 2 m.
- .4 Use guying wire with clamps for trees less than 75 mm in diameter.
- .5 After tree supports have been installed, remove broken branches with clean, sharp tools.

### 3.5 MULCHING

- .1 Ensure soil settlement has been corrected prior to mulching.
- .2 Spread mulch as indicated.

### 3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following maintenance operations from time of planting to acceptance by DCC Representative:
  - .1 Water to maintain soil moisture conditions for optimum establishment, growth, and health of plant material without causing erosion:
    - .1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
    - .2 Replace or respread damaged, missing, or disturbed mulch.
    - .3 For non-mulched areas, cultivate as required to keep top layer of soil friable.
    - .4 Remove dead or broken branches from plant material.
    - .5 Keep trunk protection and guy wires in proper repair and adjustment.

- .6 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 00 - Cleaning & Waste Management.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2 REFERENCE STANDARDS**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA):
  - .1 ANSI/AWWA C900-16, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA):
  - .1 ANSI/AWWA B300-18, Standard for Hypochlorites.
  - .2 ANSI/AWWA B301-18, Liquid Chlorine.
  - .3 ANSI/AWWA B303-18, Sodium Chlorite.
  - .4 ANSI/AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .5 ANSI/AWWA C153/A21.53-19, Standard for Ductile - Iron Compact Fittings.
  - .6 ANSI/AWWA C500-19, Standard for Metal-Seated Gate Valves for Water Supply Service.
  - .7 ANSI/AWWA C502, Dry Barrel Fire Hydrants.
  - .8 ANSI/AWWA C651-14, Standard for Disinfecting Water Mains.
  - .9 ANSI/AWWA C800-21, Standard for Underground Service Line Valves and Fittings.
  - .10 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
- .3 The Master Painters Institute (MPI):
  - .1 Architectural Painting Specification Manual, Current Edition.
- .4 ULC Standards (ULC):
  - .1 CAN/ULC-S520:2016, Standard for Fire Hydrants.
  - .2 CAN/ULC-S543-09, Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.
- .5 Provincial Legislation - Occupational Health and Safety Act.
- .6 Canada Occupational Health and Safety Regulations (1986) Amended.
- .7 MECP 2020 Disinfection Standard.
- .8 OPSS 441 - Construction Specification for Watermain Installation in Open Cut.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, product literature, and data sheets for pipes and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Pipe certification to be on pipe.
- .3 For pipe larger than 300 mm, the Contractor shall supply Engineer stamped shop drawings for thrust restraints. The restraints shall be commissioned by a third-party firm specializing in watermain installations. Costs for commissioning shall be included in the Contractors bid pricing.
- .4 A minimum of 3 weeks prior to the Work, submit for review and acceptance to the DCC Representative a watermain commissioning plan. The plan shall be prepared by a third-party firm specializing in watermain installations. All associated costs shall be included in the Contractors bid pricing.
- .5 All test reports identified in the specification shall be prepared and submitted by the third-party commissioning agency including hydrostatic and leakage test reports, flushing and disinfection reports, and bacteriological testing reports.

### **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.
  - .2 Store and protect pipes from damage.
  - .3 Replace defective or damaged materials with new.

### **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 pipe, valves, valve boxes, and hydrants for incorporation into manual.
- .3 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, and hydrant details:
  - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers, and hydrants.

### **1.6 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.

- .2 Notify DCC Representative minimum of 10 business days in advance of interruption of service.
- .3 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized.
- .4 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .5 Provide and post "Out of Service" sign on hydrant not in use.
- .6 Refer to Section 01 51 00 - Temporary Utilities, paragraph 1.5.

## **Part 2 Products**

### **2.1 PIPE, JOINTS, AND FITTINGS**

- .1 Ductile iron pipe (building interior only): to ANSI/AWWA C151/A21.51, pressure class 52, cement mortar lining with asphaltic seal coat to AWWA C104.
- .2 Joints and fittings for ductile iron pipe.
  - .1 Joints:
    - .1 Rubber gasket for flange pipe joints 1.6 mm thick: to ANSI/AWWAC111/A21.11.
    - .2 Bolts, nuts, and hex head with washers: to ASTM A307, heavy series.
  - .2 Fittings:
    - .1 All fittings to be ductile iron to AWWA C153.
- .3 Polyvinyl chloride pressure pipe (below grade): to ANSI/AWWA C900 pressure class 235, DR 18, 1 MPa gasket bell end, cast iron outside diameter:
  - .1 Flexible elastomeric seals for bell and spigot joints to ASTM D3139.
  - .2 All pipe and fittings shall be certified by CSA to meet CSA B137.3.
  - .3 Fittings shall be:
    - .1 Injection molded PVC plastic according to CSA B137.3.
- .4 Pipe Protection:
  - .1 Tracer wire on mains shall be protected with a 2.3 kg zinc anode at each end with a maximum spacing of 500 m.
  - .2 Anodes shall be exothermic welding to valves, metallic fittings, and hydrants and shall be 10.9 kg zinc casting alloy conforming to ASTM B418-16a (2021) or 14.5 kg magnesium extrusion conforming to ASTM B-843-93.
  - .3 One (1) five and a half (5.5) kg zinc anode shall be installed with each service.
  - .4 Provide cathodic protection in accordance with OPSS.MUNI 442 and OPSD 1109.011.

### **2.2 VALVES AND VALVE BOXES**

- .1 Valves to open per base standard.
- .2 Gate valves: ductile iron body to AWWA C515 with mechanical end joints:
  - .1 All valves to be push on with mechanical restraints.



- .2 All valves to be cathodically protected.
- .3 All exterior bolts to be stainless steel.
- .3 Valve boxes: to ANSI/AWWA C500, cast-iron slide type. Covers marked “water/eau”, “sprinkler/gicleur”, or “hydrant/borne” as applicable.

## **2.3 TRACE WIRE**

- .1 RWU90, number 10 gauge (AWG), single stranded, insulated copper wire with 60 mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial application.
- .2 Make all spliced or repaired wire connections in the tracer wire system waterproof using approved buried service wire closure as per manufacture instructions.

## **2.4 THRUST RESTRAINTS**

- .1 All thrust restraints shall meet OPSD 1103.010, 1103.020/021, 1105.010, and 1109.011.
- .2 Thrust blocks and anchors: 25 MPa concrete and 15M, Grade 400 reinforcing steel.
- .3 Mechanical joint restraint: ductile iron follower gland to AWWA C153 with multiple wedge restraining mechanism, minimum pressure working rating 2,410 kPa and minimum safety factor of 2:1. Lugs to have twist-off torque nuts.

## **2.5 GRANULAR BEDDING AND BACKFILL**

- .1 As indicated on drawings and to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## **2.6 HYDRANTS**

- .1 Post-type hydrants: compression type hydrant, to CAN/ULC-S520, designed for working pressure of 1,035 kPa with two 65 mm threaded hose outlets, one 100 mm STORZ pumper connection, 150 mm riser barrel, 125 mm bottom valve, and 150 mm connection for main:
  - .1 Hydrants to open counter clockwise, hose and pumper connections to be STORZ as per CFB Kingston standard.
  - .2 Provide key operated gate valve located 1 m from hydrant.
  - .3 Depth of bury 1.7 m.
- .2 Hydrant paint: exterior enamel to MPI #96:
  - .1 Colour: Yellow.

## **2.7 PIPE DISINFECTION**

- .1 Disinfect water mains in accordance with MECP 2020.

## **2.8 WATER METERS**

- .1 As supplied by the DCC Representative. DCC Representative will obtain and supply meters from Utilities Kingston. Contractor will be responsible for installation of meters.

## **2.9 BACKFLOW PREVENTER**

- .1 A Double Check Valve Assembly shall be installed at each noted location to prevent the unwanted reversal of polluted water into the potable water supply:
  - .1 The main valve body shall be manufactured from 300 series stainless steel to provide corrosion resistance.
  - .2 The main assembly shall consist of two independently operating torsion spring check assemblies, two resilient seated isolation valves, and four ball valve type test cocks:
    - .1 The check valves shall be of thermoplastic construction with stainless steel hinge pins, cam arm, and cam bearing. The check valves shall utilize a single torsion spring design to minimize pressure drop through the assembly. The check valves shall be modular and shall seal to the main valve body by the use of an O-ring. There shall be no brass or bronze parts used within the check valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling.
    - .2 The isolation valves shall be UL/FM resilient seated outside stem & yoke gate valves with flanged connections to the piping system.
- .2 The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511; CSA B64.4.

## **2.10 STRAINERS**

- .1 1379 kPa, Y-type with perforated stainless steel screen.
- .2 NPS 2 1/2 and over, ductile iron body to ASTM A536, flanged ends, with bolted cap.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation:
  - .1 Inspect materials for defects to approval of DCC Representative.
  - .2 Remove defective materials from site as directed by DCC Representative.

- .2 Contractor shall be responsible for providing valve key and manipulating all existing water valves after providing a minimum of 10 Business Days Notice to DCC Representative.

### **3.3 TRENCHING**

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Ensure trench depth allows coverage over pipe of 1.7 m minimum from finished grade or as indicated otherwise.
- .3 Trench alignment and depth require DCC Representative approval before placing bedding material and pipe.

### **3.4 GRANULAR BEDDING**

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact bedding as noted on drawings.

### **3.5 PIPE INSTALLATION**

- .1 Lay pipes to manufacturer's standard instructions and specifications:
  - .1 Do not use blocks except as specified.
- .2 Join pipes in accordance with AWWA and manufacturer's recommendations.
- .3 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .4 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 Take up and 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.
- .5 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
- .6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials:
  - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes with equipment and methods approved by DCC Representative.

- .9 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.
- .10 Align pipes before jointing.
- .11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .12 Avoid displacing gasket or contaminating with dirt or other foreign material:
  - .1 Remove disturbed or contaminated gaskets.
  - .2 Clean, lubricate, and replace before jointing is attempted again.
- .13 Complete each joint before laying next length of pipe.
- .14 Minimize deflection after joint has been made.
- .15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes.
- .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .19 Do not lay pipe on frozen bedding.
- .20 Do hydrostatic and leakage test and have results approved by DCC Representative before surrounding and covering joints and fittings with granular material.
- .21 Backfill remainder of trench.

### **3.6 HYDRANTS**

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with OPSD 1105.0010.
- .3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.
- .4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.
- .5 Place concrete thrust blocks ensuring that drain holes are unobstructed.
- .6 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.
- .7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

### **3.7 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.

### **3.8 THRUST BLOCKS AND RESTRAINED JOINTS**

- .1 Place concrete thrust blocks or mechanical restraints between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants, and fittings, and undisturbed ground as indicated.
- .2 Keep joints and couplings free of concrete.
- .3 Do not backfill over concrete within 24 hours after placing.
- .4 For restrained joints: only use restrained joints approved by DCC Representative.

### **3.9 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Do tests in accordance with OPSS 441.

### **3.10 BFP TESTING**

- .1 Tests must be completed in accordance with the Utilities Kingston Backflow Prevention Control Program and the CSA B64 Standard. All testers must be registered with Utilities Kingston and meet certification requirements.

### **3.11 PIPE SURROUND**

- .1 Upon completion of pipe laying and after DCC Representative has inspected Work in place, surround and cover pipes as indicated on drawings.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact pipe surround as noted on drawings.

### **3.12 BACKFILL**

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Compact backfill as noted on drawings.

### **3.13 FLUSHING AND DISINFECTING**

- .1 Do all flushing and disinfecting to MECP 2020.
- .2 Flushing and disinfecting operations: witnessed by DCC Representative:
  - .1 Notify DCC Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .3 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
- .4 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

- .5 After adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 hours:
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- .6 Copies of all results must be provided to DCC Representative. Approval from DND Water Authority and Utilities Kingston (in some instances) is required prior to final tie-in.

### **3.14 HYDRANT FLOW TESTS**

- .1 Conduct flow tests on every hydrant to determine fire flows before painting hydrant caps and ports:
  - .1 Flow testing is to be completed pre-construction and post construction.

### **3.15 SURFACE RESTORATION**

- .1 After installing and backfilling over water mains, restore surface to original condition as indicated.

### **3.16 CLEANING**

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

**END OF SECTION**

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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1       Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2               REFERENCE STANDARDS**

- .1       ASTM International:
  - .1       ASTM D3350, Standard Specifications for Polyethylene Plastic Pipes and Fittings Materials.
- .2       CSA Group (CSA):
  - .1       CSA B182.2, Profile Polyethylene Storm Sewer and Drainage Pipe and Fittings.

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

- .1       Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2       Product Data:
  - .1       Submit manufacturer's instructions, printed product literature, and data sheets for pipes and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3       Certification: to be marked on pipe.
- .4       Test and Evaluation Reports:
  - .1       Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.

**1.4               DELIVERY, STORAGE, AND HANDLING**

- .1       Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2       Storage and Handling Requirements:
  - .1       Store materials in accordance with manufacturer's recommendations.
  - .2       Store and protect pipes from damage.
  - .3       Replace defective or damaged materials with new.

**Part 2            Products**

**2.1               CORRUGATED POLYETHYLENE PIPE AND FITTINGS**

- .1       HDPE pipe to ASTM D3350 and CSA B182.8. Pipe stiffness of 320 kPa. Size as indicated on the plans.

**2.2               GRANULAR BEDDING AND BACKFILL**

- .1       Granular bedding and backfill material to Section 31 23 33.01 - Excavating, Trenching and Backfilling and as indicated on the plans.

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**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 pipe culvert 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 DCC Representative.

**3.2                TRENCHING**

- .1      Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2      Obtain DCC Representative's approval of trench line and depth prior to placing bedding material or pipe.

**3.3                BEDDING**

- .1      Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2      Place 150 mm minimum thickness of approved granular material on bottom of excavation and compact to 100% minimum SPMDD to ASTM D698.
- .3      Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by DCC Representative, free from sags or high points.
- .4      Place bedding in unfrozen condition.

**3.4                LAYING CORRUGATED POLYETHYLENE PIPE CULVERTS**

- .1      Begin laying at downstream end of culvert.
- .2      Install pipe in trench by lowering.
- .3      Ensure bottom of pipe is in contact with shaped bedding throughout pipe length.
- .4      Allow water to flow through pipes during construction only as permitted by DCC Representative.

**3.5                JOINTS FOR POLYETHYLENE CULVERTS**

- .1      Install couplings in accordance with manufacturer's instructions.

**3.6                BACKFILLING**

- .1      Backfill over culverts as indicated.
- .2      Place granular backfill material, in 300 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.



- .3 Compact each layer to 98% SPMDD taking special care to obtain required density under haunches.
- .4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross:
  - .1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
- .5 Place backfill in unfrozen condition.

### **3.7 CLEANING**

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

**END OF SECTION**

## **Part 1 General**

### **1.1 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.
  - .3 ASTM C139-17, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
  - .4 ASTM C478/C478M-20, Standard Specification for Precast Reinforced Concrete Manhole Sections.
  - .5 ASTM D1056-20, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- .2 CSA Group (CSA):
  - .1 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004, and A3005):
    - .1 CSA-A3001-13, Cementitious Materials for Use in Concrete.
  - .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.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
  - .1 Submit shop drawings for precast manholes.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control:
  - .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, and cleaning procedures.

### **1.3 QUALITY ASSURANCE**

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning on-site installation, with DCC Representative:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Coordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling, and unloading:
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store, and handle materials in accordance with manufacturer's instructions.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

## **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 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 PRECAST CONCRETE MANHOLES**

- .1 Precast concrete manholes and auxiliary sections fabricated in steel forms.
- .2 Aggregates: To CSA A23.1/A23.2.
- .3 Cement: To CAN/CSA-A3001, Type GU.
- .4 Steel welded wire fabric mesh reinforcing: To ASTM A82/A82M, ASTM A185/A185M, and CAN/CSA-G30.18.
- .5 Pulling inserts and bolts for racks integrally cast in concrete.
- .6 Neoprene gasket seals between manhole sections: To ASTM D1056.
- .7 Precast Concrete Manholes: to ASTM C478/C478M.

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**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 GENERAL**

- .1        Install underground duct banks and manholes including formwork.
- .2        Build duct bank and manholes 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        Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.
- .5        Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.
- .6        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.
- .7        Make transpositions, offsets and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.
- .8        Use bell ends at duct terminations in manholes or buildings.
- .9        Use conduit to duct adapters when connecting to conduits.
- .10       Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.
- .11       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.
- .12       Allow concrete to attain 50% of its specified strength before backfilling.
- .13       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.
- .14       Clean ducts before laying:
  - .1        Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

- .15 Duct Cleaning:
  - .1 Pull 300 mm long x diameter 6 mm less than internal diameter of duct wooden or steel 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.
- .16 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.
- .17 Install pull rope continuous throughout each duct run with 3 m spare rope at each end.

### **3.3 SITE QUALITY CONTROL**

- .1 Site Tests/Inspections:
  - .1 Inspection of duct will be carried out by DCC Representative prior to placing.
  - .2 Placement of concrete and duct cleanout to be done when DCC Representative present.

### **3.4 CLEANING**

- .1 Proceed in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**

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**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

**1.2 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control:
  - .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.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Packaging Waste Management: Remove in accordance with Section 01 74 00 - Cleaning & Waste Management.

**Part 2 Products**

**2.1 PVC DUCTS AND FITTINGS**

- .1 Rigid PVC duct: Schedule 40, with moulded fittings, for direct burial expanded flange ends, Trade size as indicated:
  - .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, and adaptors same product material as duct, to make a complete installation.
- .4 Rigid PVC 90°, 45° bends and 5° 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 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 pipe or 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 steel or 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 field review upon completion of direct buried ducts and obtain acceptance prior to backfill.

### **3.3 CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning & Waste Management:
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: Separate waste materials in accordance with Section 01 74 00 - Cleaning & Waste Management.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1    National Sanitation Foundation/American National Standards Institute (NSF/ANSI):
  - .1        NSF/ANSI 61- 2020, Drinking Water System Components - Health Effects.
- .2    ASTM International (ASTM)
  - .1        ASTM D2564- 20, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .3    CSA Group (CSA)
  - .1        CAN/CSA-Series B1800- 21, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .4    Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1        Safety Data Sheets (SDS).
- .5    National Research Council Canada (NRC):
  - .1        National Plumbing Code of Canada 2020 (NPC).

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Shop Drawings:
  - .1        Submit manufacturer's instructions, printed product literature, and data sheets for refrigerant piping, fittings and equipment 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 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2    Delivery and Acceptance Requirements:
  - .1        Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3    Storage and Handling Requirements:
  - .1        Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, and 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: remove for reuse or recycling of pallets, crates, padding, and/or packaging materials in accordance with Section 01 74 00 - Cleaning & Waste Management.



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**Part 2            Products**

**2.1                DUPLEX CHEMICAL FEED PUMP PACKAGE**

- .1 The duplex chemical feed pump package shall be a wall-mount skid complete with all piping, connection points, valves, gauges, and power connections:
  - .1 Construction: Pipe support frame shall be made from 12.7 mm thick HDPE sheet, with 304SS mounting hardware and plastic pipe clips and standoffs.
  - .2 Piping connections: 12.7 mm (NPS 1/2) schedule 80 PVC socketweld.
  - .3 Seal material: PTFE and viton.
  - .4 Components:
    - .1 Back pressure valve assembly.
    - .2 100 mL calibration column assembly. 12.7 mm PVC.
    - .3 Pressure relief valve.
    - .4 Pressure gauge.
    - .5 2x wall-mount polyethylene pump shelf.
  - .5 Control Panel:
    - .1 Enclosure: FRP NEMA 4X, Screw cover door, non-hazardous area classification.
    - .2 Electrical: 15A, 125V, 5-15R Simplex Receptacle assemble NEMA3R - 2 plugs.
- .2 Pumps (P-X):
  - .1 The chemical feed pumps shall be solenoid diaphragm metering pumps, with auto degassing liquid ends, with two pumps serving each dosing station.
  - .2 Housing: Fibreglass reinforced PPE (Polyphenylene Ether).
  - .3 Diaphragm: PTFE face EPDM with plastic core.
  - .4 Dosing head: Clear acrylic.
  - .5 Suction/Discharge Valves: PVC.
  - .6 Ball Seat: EPDM.
  - .7 Seals: EPDM.
  - .8 Balls: Ceramic.
  - .9 Capacities at Maximum Backpressure:
    - .1 Psig: 232.
    - .2 Flow rate: 1.3 L/h.
    - .3 ML/stroke: 0.11
  - .10 Pre-primed Suction Lift: 2.1 m

**2.2                CHEMICAL FEED TUBING/PIPING**

- .1 Schedule 80 PVC suitable for 75% concentration phosphoric acid.

- .2 Fittings: Socket weld.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions and as specified.
- .2 Piping:
  - .1 In accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.
  - .2 Install in accordance with the National Plumbing Code and manufacturer's recommendations.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection, and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

#### **3.4 ADJUSTING**

- .1 General:
  - .1 Test and adjust chemical feed equipment in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified.
- .2 Adjustments:
  - .1 Verify that flow rate and pressure meet design criteria.
- .3 Pressure relief valve assembly:
  - .1 Adjust settings to suit location, flow rate, and pressure conditions.

#### **3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning & Waste Management.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning & Waste Management.

**END OF SECTION**