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DEPARTMENT OF NATIONAL DEFENCE

REAL PROPERTY OPERATIONS UNIT (ONTARIO)
DETACHMENT (4CDTC Meaford)

SPECIFICATION
ISSUED FOR TENDER

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

Building M-206 Refrigeration Lifecycle

Meaford, ON

PROJECT MANAGER:

WICKEND, DOUGLAS 680

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Canadian Armed Forces

JOB NO: L-M95-4901/6
WBS #: N203111.03.02
File #: MF500039

2021-01-26

LIST OF DRAWINGS

DRAWING NO.	TITLE
MECHANICAL	
L-M95-4901/6-401	NOTES, SYMBOLS, ABBREVIATIONS, AND DESIGN CRITERIA
L-M95-4901/6-402	EXISTING HYDRONIC SYSTEM SCHEMATIC - DEMOLITION
L-M95-4901/6-403	EXISTING KITCHEN REFRIGERATION SYSTEM LAYOUT - DEMOLITION
L-M95-4901/6-404	EXISTING PENTHOUSE REFRIGERATION SYSTEM LAYOUT - DEMOLITION
L-M95-4901/6-405	KITCHEN NEW REFRIGERATION LAYOUT
L-M95-4901/6-406	PENTHOUSE NEW REFRIGERATION SYSTEMS LAYOUT
L-M95-4901/6-407	EXISTING PLUMBING DEMOLITION AND NEW PLUMBING LAYOUTS FOR DISHWASHERS
L-M95-4901/6-408	NEW SCHEMATICS - HYDRONIC AND REFRIGERANT
L-M95-4901/6-409	MODIFIED HYDRONIC SYSTEM SCHEMATIC AND SEQUENCE OF OPERATION
L-M95-4901/6-410	EQUIPMENT SCHEDULES
ELECTRICAL	
L-M95-4901/6-501	GENERAL DRAWING NOTES, ABBREVIATIONS, AND SYMBOLS
L-M95-4901/6-502	ELECTRICAL LAYOUT - KITCHEN
L-M95-4901/6-503	ELECTRICAL LAYOUT - PENTHOUSE

Part 1 General

1.1 SECTION INCLUDES

.1 Title and description of Work.

.2 Work sequence.

.3 Contractor use of premises.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises various renovations to building M-206, 4CDTC Meaford, ON.

.1 Work comprises mechanical and electrical upgrades and alterations including but not limited to:

.1 Removal and replacement of thirteen (13) walk-in cooler and freezer refrigeration systems

.1 New refrigeration system shall be complete with the following: water cooled condenser; hermetic, semi-hermetic or scroll compressor with overload protection and contactors (as required), fan guards, receiver tank with liquid shut off valve, suction line accumulator (on 2.2 kW systems and higher only), liquid line filter / drier and sight glass, high / low pressure control, liquid line solenoid valve, crankcase heater, low ambient controls to -28.9° C, room thermostat and CSA/ULC labeled electrical control panel wired in accordance with CEC standards.

.2 Evaporator coils shall be furnished with electronically commutated fan motors and appropriate defrost for operating temperature range.

.3 Electric defrost shall be included on all refrigeration systems operating at 0° C and below. Electric defrost shall be time initiated and temperature terminated with time override and fan delay to reduce room condensation.

.4 Refrigeration systems operating at 0° C and above shall be off-cycle air defrost. Defrost periods shall be time initiated and time terminated.

.5 All evaporator condensate pans shall be piped to existing copper drain line complete. All condensate piping within freezers shall be provided with heat trace.

.2 Heat-recovery heat exchanger and related ancillary equipment installation

.3 Installation of dedicated domestic water softener for kitchen dishwashers and related domestic water piping modifications

1.3 LOCATION OF THE SITE

4CDTC Meaford is located at 139152 Grey Rd 112, Meaford, ON approximately 2.5 hrs northwest of Toronto.

1.4 SITE ACCESS

.1 Upon entering the Base, the Contractor has voluntarily consented to a search of his vehicle and its contents while on any part of 4CDTC Meaford and said military establishments, by the Base Commander or person designated by him.

.2 The purpose of any search conducted is to ensure the security of 4CDTC Meaford and said military establishments, and/or material or classified information belonging to the Canadian Armed Forces.

1.5 CONTRACTOR TRAFFIC ROUTE

.1 All contract related commercial motor vehicles must use the main entrance to enter and exit 4CDTC Meaford. Furthermore, these vehicles must use the shortest distance to the intended destination to navigate around the Base. This requirement extends to all subcontractors and delivery vehicles.

.2 Commercial motor vehicles are defined as any heavy equipment, tractor trailers, cement trucks, dump trucks, cranes, any vehicle towing a trailer, and delivery type trucks larger than cube vans.

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

1.6 OWNER OCCUPANCY

.1 Owner will occupy premises during selected portions of construction period for execution of normal operations.

.2 Co-ordinate with DCC Representative in scheduling operations to minimize conflict and to facilitate Owner usage.

.3 As part of the coordination between occupant and the contractor the contractor shall prepare and submit a Fire Safety Plan. The plan shall be based on the DND Template to be provided by DCC. The plan will further define the phases of the work, the timing of the phases, communication planning with occupants and also will include drawings depicting emergency exit plans for each phase of the work.

.4 Refer to Section 01 70 03, Safety Requirements for further details.

1.7 CONTRACTOR USE OF PREMISES

.1 Contractor shall limit use of premises for Work, to allow;

.1 Owner occupancy.

.2 Public usage.

.2 Coordinate use of premises under direction of DCC Representative.

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

1.8 CONTRACTOR'S WORKING HOURS

.1 Contractor's regular working hours are:

.1 Contractor's allowable working hours for work in the Kitchen:

.1 Monday-Sunday from 2000 to 0300 hrs (0300-0400 reserved for clean up and inspection by kitchen lead)

.2 From December 1, 2025 to January 4, 2026 the building will be unoccupied and working hours are revised to Monday-Sunday from 0000 to 2359 hrs

.1 To ensure that Commissionaire services are provided when work is being completed during unoccupied hours, contractor shall make a written request for approval to DCC Representative at least 48 hours in advance.

.2 Work at building penthouse mechanical room and roof may be performed during daytime hours if not disruptive to building occupants and operations

1.9 WORK SEQUENCE

.1 Construct Work in stages to accommodate Owner's continued use of premises during construction. Except as noted for Block Leave period, building will remain in normal daily operation.

.2 Separate and secure each construction area to allow for the rest of the building to remain occupied and fully operational during non-block leave period. Ensure safe access to washrooms.

.1 **Not Used**

.3 Contractor's access to the construction zone shall be by the indicated doors only. Occupant will unlock and lock each day unless otherwise arranged with DCC Representative.

.1 External door for Stair 187 will be used for all penthouse work.

.2 The door for Vestibule 195 can be used by Contractor when kitchen is not in operation.

.4 Upon award of contract, the contractor is to proceed with shop drawing review and subsequent immediate procurement and delivery of all equipment.

.5 Moving in of construction materials shall be done during unoccupied hours.

.6 Conduct all taping, sanding and painting of walls and bulkheads in kitchen area during unoccupied hours.

.7 The following staging of work has been determined to be practical:

.1 Kick-off meeting

.2 Submittals

.3 Equipment lead time - heat exchanger

.4 Equipment lead time - refrigeration

.5 Site mobilization, housekeeping pads

.6 Water softener installation

.7 Compressor & fluid cooler install

.8 Heat recovery installation (less HX)

.9 Reefer container mobilization

.10 Construction period - block leave

- All cooler and freezer evaporator replacements and refrigerant piping

.11 Startup refrigeration systems

.12 Reefer container demobilization

.13 Demolish existing compressors

.14 HX housekeeping pad

.15 HX installation and startup

.16 Commissioning and Closeout

.17 Commissioning and training

.18 Deficiency resolution

.19 Final completion

.8 In each stage area listed above the Contractor is required to:

.1 Move and cover furniture and equipment as necessary to perform the work and to protect furniture/equipment from dirt and damages. Replace covers as work progress.

.2 Move in and out large tools/construction materials during unoccupied hours with the exception of the winter shutdown period.

.3 Complete all mechanical, electrical, structural and architectural work during allocated time frame.

.4 When working afterhours in the occupied areas, contractor shall clean and return the construction areas back to its original state upon completion of each working day.

.9 The Contractor is to include in the Tender Price for costs associated with this sequencing, including overtime and shift pay costs.

.10 Maintain fire route access/control at all times.

.11 Construct Work in stages listed above to accommodate Owner's continued use of premises as needed.

1.10 PROVISION OF TEMPORARY REFRIGERATION

.1 During the removal and replacement of cooler and freezer evaporator systems during Block Leave which will leave the coolers and freezers non-operational, provide temporary cooling equipment at M-206 parking lot as follows for a minimum of 28 days, overlapping start and finish of Block Leave by minimum of three (3) days:

.1 Four (4) 20’ ISO container type (5.90 m L x 2.35 m W x 2.39 m H)

.2 Adjustable temperature to minimum -25 C

.3 Diesel generator(s), distribution panel(s) and cabling as required for continuous operation

.2 Delivery to site, unloading, setup, breakdown when complete, loading and removal from site to be included

.3 Placement of refrigerated containers and support equipment to be determined in conjunction with and approved by DCC representative.

.4 Contractor shall allow for required for required fuel monitor fuel levels and refill tank at minimum of 25% fuel capacity to ensure uninterrupted operation.

.5 Temporary installation shall be in conformance with CEC/CSA C22.1, OESC and applicable fuel and environmental codes.

1.11 REFERENCES AND CODES

.1 National Building Code of Canada (NBC) and National Fire Code of Canada (NFC) including all amendments up to tender closing date.

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

.3 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.12 PROJECT/SITE CONDITIONS

.1 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 following are the known hazardous substances and/or hazardous conditions at the work site which shall be considered as health or environmental hazards and shall be properly managed should they be encountered as part of the work:

.1 Silica, as present in common construction sand, is present in all concrete and masonry products where present in the project area.

.3 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.

.4 Contractor must provide guardrail system for roof work and ensure that openings are protected at all times. Guardrail must be maintained for the duration of the project, including for training and demonstration purposes.

1.13 HAZARDOUS MATERIALS

.1 Silica is known to be present within existing building materials.

1.14 BUILDING SMOKING ENVIRONMENT

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

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

1.15 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 and await DCC Representatives written instructions before proceeding with work in this area.

.3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

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

1.2 APPOINTMENT AND PAYMENT

.1 DCC Representative will appoint and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Assurance (QA) testing, except follows:

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

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

.3 Mill tests and certificates of compliance.

.4 Tests specified to be carried out by Contractor under the supervision of DCC Representative.

.5 Additional tests specified in the following paragraph.

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

1.3 CONTRACTOR'S RESPONSIBILITIES

.1 The contractor to furnish and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Control (QC) testing in accordance with the contractor's quality control plan.

.2 Provide labour, equipment and facilities to:

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

.2 Facilitate inspections and tests.

.3 Make good Work disturbed by inspection and test.

.3 Notify DCC Representative sufficiently in advance of testing & inspection operations (24 hours minimum).

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

.5 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed.

END OF SECTION

Part 1 General

1.1 PROJECT MEETINGS

.1 DCC Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.2 ON-SITE DOCUMENTS

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

- .1 Contract drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed shop drawings.
- .5 Change orders.
- .6 Other modifications to Contract.
- .7 Field test reports.
- .8 Copy of approved Work schedule.
- .9 Manufacturers' installation and application instructions.

1.3 SCHEDULES

.1 Contractor to submit a detailed construction progress schedule to DCC Representative within 10 working days of the Contract award and at least 10 working days prior to the submission of the first progress claim. The construction progress schedule must show anticipated progress stages and final completion of the work within the time periods required by the Contract documents.

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

1.4 CLOSEOUT PROCEDURES

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

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

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

.4 Notify DCC Representative of instructions for completion of items of Work determined in DCC Representative's final inspection.

1.5 COST BREAKDOWN

.1 Contractor to submit a detailed cost breakdown to DCC Representative within ten (10) working days the Contract award. After approval by DCC Representative the cost breakdown will be used as basis for progress payment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples.

1.2 ADMINISTRATIVE

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

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

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

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to DCC Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.

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

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

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

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

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

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which

adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

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

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

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

.6 Accompany submissions with transmittal letter containing:

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

.7 Submissions shall include:

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

.8 After DCC Representative's review, distribute copies.

.9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as DCC Representative may reasonably request.

.10 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by DCC Representative where shop drawings will not be prepared due to standardized manufacture of product.

.11 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by DCC Representative.

.1 Report signed by authorized official of testing laboratory 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.

.12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by DCC Representative.

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

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

.13 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by DCC Representative.

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

.14 Submit electronic copies of Manufacturer’s Field Reports for requirements requested in specification Sections and as requested by DCC Representative.

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

.16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by DCC Representative.

.17 Delete information not applicable to project.

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

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

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

.1 This review shall not mean that the DCC Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents.

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

1.4 SAMPLES

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

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

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

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

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

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

1.5 MOCK-UPS

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Definitions:

.1 Contract Security Program (CSP) - A division of Public Services and Procurement Canada (PSPC), which developed the Contract Security Manual and helps industry to participate in Government of Canada and foreign government contracts. CSP provides security screening services needed for contractors before their employees can work with Protected and Classified information and assets.

.2 Company Security Officer (CSO) - The CSO is the organization's official point of contact with the CSP. The CSO is responsible for monitoring the organization's security profile, addressing security issues, and is accountable to the CSP and to the organization's designated Key Senior Official on all industrial security matters.

.3 Contractor CSO - The employee of the Contractor’s company who is the CSO.

.4 Contract Security Manual (CSM) - The CSM is a ready and simple reference which tells Company Security Officers what they must know about Canadian government security standards and procedures and how to ensure that their organization meets these security requirements.

.5 Positive Control - Measures which guarantee that persons without appropriate clearance will not be left unattended to access the Department of National Defence/Canadian Armed Forces (DND/CAF) information, assets, resources, or locations.

.6 Request for Visit (RFV) - A form to be filled out by an individual who requires access to sensitive DND property, personnel, information, assets and resources because they must be security screened at the appropriate level before commencement of their duties.

.7 Restricted - Refers to a situation where authorized persons only, are allowed access to an area or information.

.8 Security Implementation Plan - A detailed document which outlines the company’s strategy and process to meet contract security requirements.

.9 Security Requirements Check List (SRCL) - The SRCL is a Treasury Board Secretariat (TBS) form used to define the security requirements for a contract. The SRCL represents an evaluation of security threats and risks that may arise through the contracting process.

.10 Sensitive - Records that are sensitive contain information that can cause different degrees of injury to an individual, a company, or the country if the information were disclosed in an unauthorized manner.

.2 Reference Sites:

.1 Defence Construction Canada (DCC)

.1 https://www.dcc-cdc.gc.ca/industry/security-requirements

.2 PSPC Contract Security Manual

.1 https://www.tpsgc-pwgsc.gc.ca/esc-src/msc-csm/index-eng.html

1.3 GENERAL

.1 Security requirements must form part of the contract between DCC and industry when defined by a SRCL.

.2 These security requirements apply but are not limited to:

.1 construction and material objects;

.2 contractual arrangements;

.3 professional service contracts;

.4 facility maintenance contracts; and

.5 environmental and UXO contracts.

.3 A SRCL is a form that is used to define the security requirements associated with each contract. The SRCL ensures that that the appropriate security clauses are identified so they may be incorporated into the contract, thereby legally binding the parties to meet the contract's security requirements. **The SRCL must accompany all contract documents including subcontracts that contain security requirements**.

.4 If multiple levels of screening are required, a Security Classification Guide may have been provided along with the SRCL as a contractual document. This document will provide further information related to security requirements when dealing with multiple levels of clearances within the contract.

1.4 PRIVATE SECTOR ORGANIZATION SCREENING AND CLEARANCES

.1 Companies who will need access to or who will retain controlled goods, protected or classified property, information, assets or resources must be cleared as follows:

.1 Companies must be cleared to safeguard the highest level of information and asset to be retained/accessed, meaning:

.1 Designated Organization Screening (DOS) is required for contracts involving access to information at the protected level and/or secure worksites (Reliability status);

.2 Facility Security Clearance (FSC) is required for contracts involving access to information at the protected and/or classified levels and/or secure worksites (Secret status);

.3 Document Safeguarding Capability (DSC) is required to work on protected and/or classified information at their own worksite; and

.4 Companies who will electronically process protected or classified information must have IT media clearance and processing capability commensurate with the security classification level of the information to be processed and must be cleared to the level commensurate with the information or asset to be accessed.

1.5 PERSONNEL SECURITY SCREENING

.1 Individuals requiring access to information and/or site must have their personnel security screening completed prior to submitting an RFV. As a part of the screening process, it is now a requirement for individuals to undergo a law enforcement inquiry through the RCMP, for electronic finger printing. Please refer to PSPC website for more information.

.2 Prior to Contract Award, personnel security screenings may not be initiated due to CSP requirements. Therefore, contractors must allow time in their schedules to seek personnel security screenings as required by the contract.

.1 Reliability status processing is anticipated to take seven (7) business days per employee after a request has been properly submitted to CSP; and

.2 Secret clearance processing is anticipated to take seventy-five (75) business days per employee after a request has been properly submitted to CSP.

1.6 VISIT CLEARANCE REQUESTS (VCR) APPROVAL

.1 All individuals (including subcontractors) who will have access to sensitive DND or CAF property, personnel, information, assets, and resources, must be security screened at the appropriate level before the commencement of their duties in relation to the contract.

.2 Access to Operations Zones: security screening is not required for certain personnel if positive control of those individuals is maintained throughout their visit. Positive control measures must be outlined in the Security Implementation Plan. Positive control can be used for the following personnel:

.1 Logistics activities – material drop-off, waste removal, snow removal;

.2 Transit through an operations zone (no work); and

.3 Authorities having jurisdiction.

.3 The VCR process verifies that those who are permitted access onto DND property have the required clearance level as outlined within the SRCL for the contract.

1.7 POST AWARD PROCESS OVERVIEW

.1 The Contractor’s CSO is provided a blank RFV form by the DCC Representative in order to obtain an approved VCR.

.2 All employees of the successful bidder who will be accessing restricted sites or sensitive information during the execution of the contract require a VCR. The Contractor’s CSO must forward the completed form to the DCC Representative for processing.

.1 The CSO of each company completing an RFV form must submit a picklist from the Online Industrial Security Services (OLISS) portal instead of filling in the details of each visitor on the form. Only the employees of the company who require access to the restricted site or sensitive information for that contract shall be listed on the picklist.

.2 If the Contractor intends to use Union Hall members, the CSO will request the Union Hall to provide the CSO with a separate picklist for all members to be used on the contract. Only the individuals of the Union Hall who require access to the site for that contract shall be listed on the picklist.

.3 The CSO of the company will input “SEE ATTACHED PICKLIST” when completing Particulars of Visitors.

.3 It is the responsibility of the Prime Contractor to submit and receive an approved SRCL for each subcontract containing security requirements. This responsibility extends to all subcontracts held by subcontractors.

.1 Instructions on this process are in the CSM located at https://www.tpsgc-pwgsc.gc.ca/esc-src/msc-csm/index-eng.html

.2 Prior to Contract Award, subcontract SRCL security screenings may not be initiated due to CSP requirements. Therefore, contractors must allow time in their schedules for subcontract SRCL approvals as required by the contract.

.1 When a Private Sector Organization Screening (PSOS) is **not** required, contractors shall allow 45 business days (from the date on which a complete and correct subcontract SRCL is received by CSP) for approval of a subcontract SRCL by CSP.

.2 When a PSOS **is** required:

.1 For sub-contractors to be sponsored to the level of DOS, contractors shall allow for 50 business days (from the date on which a complete and correct PSOS is submitted to CSP) for approval of a subcontract SRCL by CSP; and

.2 For sub-contractors to be sponsored to the level of FSC (Secret), contractors shall allow 124 business days (from the date on which a complete and correct PSOS is submitted to CSP) for approval of a subcontract SRCL by CSP.

.3 All security related pre-construction activities shall proceed immediately after award.

.4 For subcontracts, the RFV shall not be submitted until after the subcontract SRCL has been approved and permission to award the contract is granted by CSP.

.1 Contractor to allow a minimum of 15 business days for VCR processing.

.5 Personnel not meeting the required security clearances will not be allowed access to restricted sites or any sensitive information pertaining to the contract, except as permitted in 1.6.2.

.6 Approved VCRs are valid for the duration of the contract **or** one year less one day, whichever is less. Extension to VCRs will need to be requested as required, again allowing a minimum of 15 business days for processing.

1.8 SUBMITTALS

.1 Submit to the DCC Representative copies of the following documents, including updates issued:

.1 Security Implementation Plan

.2 Approved subcontract SRCLs

.3 Completed Request for Visit forms for all personnel working under the contract

.4 Incident reports within (1) working day

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

1.9 RESPONSIBILITY

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

1.10 MEETINGS

.1 Prior to commencement of work, the Contractor will attend a pre-commencement meeting conducted by the DCC Representative. Ensure, as minimum, attendance by Contractor's site superintendent.

.1 The DCC Representative will advise of time, date and location of the meeting and will be responsible for recording and distributing the minutes.

.2 If requested by the DCC Representative, the Contractor's CSO will be required to participate in the pre-commencement meeting.

.2 Conduct site specific security meetings as required to ensure the management of security is in accordance with the contract.

.1 Record and post minutes of all meetings as allowed by the security requirements of the contract.

1.11 SECURITY IMPLEMENTATION PLAN

.1 Contractors are required to have in place a contract specific Security Implementation Plan that addresses the security requirements outlined in the contract.

.2 Provide one copy of the Security Implementation Plan to the DCC Representative prior to the commencement of work.

.3 At a minimum, the plan shall contain details addressing:

.1 CSO name and contact information;

.2 Schedule for subcontract SRCLs and RFVs;

.3 Site Access and Control Monitoring including verification that all people entering secure areas on site have approved VCRs in accordance with contractual security requirements, or any planned positive control measures;

.4 Security Education (i.e. Restrictions on photographs); and

.5 Security Incident Reporting.

.4 The DCC Representative will coordinate review of the Security Implementation Plan by the DND Project Security Authority to be completed within 10 business days of receipt following which the DCC Representative shall confirm DND's acceptance or rejection with comments.

1.12 INCIDENT REPORTING

.1 Investigate and report any security incidents immediately to the DCC Representative.

.1 Immediately provide a copy of the incident/investigation reports to the DCC Representative.

.2 Refer to Chapter 5 of the CSM https://www.tpsgc-pwgsc.gc.ca/esc-src/msc-csm/index-eng.html for more information.

.2 For the purpose of this contract, immediately notify the DCC Representative of incidents that involve a security breach from the identified clauses on the SRCL or an interruption to adjacent and/or integral infrastructure operations with potential loss implications.

.3 In the investigation and reporting of incidents, the Contractor is required to respond in a timely fashion (within 5 working days) to correct the action that was deemed to have caused the incident and advise in writing on the action taken to prevent a re-occurrence of the incident.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 CONSTRUCTION FIRE SAFETY

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

1.2 RELATED SECTIONS

.1 Section 01 35 43 Environmental Procedures

.2 Section 01 70 03 Safety Requirements

.3 Section 02 81 01 Hazardous Materials

1.3 REFERENCES

.1 Occupational Health and Safety Act (OHSA)

.1 Ontario Regulation 632/05- Confined Spaces

.2 Government of Canada

.1 Canada Labour Code, Part II - Canada Occupational Health and Safety Regulations (COHSR), SOR/86-304, Part XI- Confined Spaces,

.2 National Fire Code of Canada (NFC),

.3 Canadian Forces Fire Marshall Directive FMD4003 Fire Protection and Life Safety Engineering Design

1.4 FIRE DEPARTMENT BRIEFING

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

1.5 REPORTING FIRES

.1 The Contractor shall inform the DCC representative and Base Fire Department of all fire incidents at the construction site, regardless of size.

.2 Know location of nearest fire alarm pull station and telephone, including emergency phone number.

.3 Report immediately fire incidents to Base Fire Department as follows:

.1 Activate nearest fire alarm pull station.

.2 Telephone 911, Inform dispatcher of location at 4CDTC Meaford

.4 Person activating fire alarm pull station will remain at the front entrance to direct Base Fire Department to scene of fire.

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

1.6 FIRE SAFETY PLAN

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

.2 The fire safety plan shall be submitted to the DCC representative for review by Base Fire Department. Any comments by Base Fire Department shall be implemented by the Contractor.

.3 The fire safety plan shall be limited to the area of construction only. Contractor is not responsible for amending fire safety plans in existing buildings.

.4 Post the fire safety plan at the entrance to the construction site or near the construction site's health and safety board.

.5 The fire safety plan shall conform to the National Fire Code of Canada, and shall contain, at minimum:

- .1 Emergency procedures to be used in case of fire, including
  - .1 Sounding the fire alarm;
  - .2 Notifying the fire department;
  - .3 Instructing occupants on procedures to be followed when the fire alarm sounds;
  - .4 Evacuating occupants, including special provisions for persons requiring assistance; and
  - .5 Confining, controlling and extinguishing fires.
- .2 The appointment and organization of designated supervisory staff to carry out fire safety duties.
- .3 The training of responsibilities for supervisory staff and other occupants.
- .4 Documents including diagrams, showing the type, location and operation of building fire emergency systems.
- .5 The holding of fire drills (where applicable).
- .6 The control of fire hazards in the building.
- .7 The inspection and maintenance of building facilities provided for the safety of occupants.

1.7 FIRE WARNING SYSTEM

.1 A fire warning shall be provided to notify construction personnel of a fire emergency in the construction area.

.2 The system used shall be capable of being heard throughout the building.

1.8 INTERIOR AND EXTERIOR FIRE PROTECTION AND ALARM SYSTEMS

.1 Fire protection and alarm system will not be:

.1 Obstructed.

.2 Shut-off.

.3 Left inactive at end of working day or shift without prior written authorization from the Base Fire Department.

.2 Do not use Fire hydrants, standpipes or hose systems for other than fire-fighting purposes unless authorized by the Base Fire Department.

1.9 FIRE PROTECTION SYSTEM IMPAIRMENT

.1 Notify the DCC Representative, by completing a Fire Alarm Impairment Permit, 48 hours (for coordination with Base Fire Department and local facility management provider (Canadian Base Operators) Fire alarm techs) prior to shutting down any active fire protection system, including water supply, fire suppression, fire detection and life safety systems.

.2 Where a fire protection system that provides fire alarm monitoring is impaired in an existing building, a fire watch may be required at the discretion of the Base Fire Department.

.3 Implement all fire protection system impairments in accordance with the National Fire Code of Canada and Base Fire Orders. Fire Orders will be provided at the Pre-Commencement Meeting.

1.10 FIRE EXTINGUISHERS

.1 In addition to other requirements of this specification, supply fire extinguishers, as scaled by the Base Fire Department, necessary to protect work in progress and contractor's physical plant on site.

.2 Fire extinguishers may be required in the following areas as directed by the Base Fire Department

.1 Adjacent to hot works;

.2 In areas where combustibles are stored;

.3 Near or on any internal combustion engines;

.4 Adjacent to areas where flammable liquids or gases are stored or handled;

.5 Adjacent to temporary oil fired or gas fired equipment; and

.6 Adjacent to bitumen heating equipment.

.3 Extinguishers shall be sized as 4-A: 40-B: C (20 lbs) unless otherwise directed by the Base Fire Department.

.4 Extinguishers shall be of the dry chemical type unless otherwise required by the hazard being protected.

.5 The Contractor may assume the quantity of extinguishers based on a maximum travel distance between extinguishers of 75 feet.

1.11 ACCESS FOR FIRE FIGHTING

.1 Access for firefighting shall be provided in accordance with the National Fire Code of Canada.

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

.3 Minimum horizontal clearance: clear width of not less than 5m, or as defined by the Base Fire Department.

.4 Minimum vertical clearance: overhead height of not less than 6m, or as defined by the Base Fire Department.

1.12 SMOKING PRECAUTIONS

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

1.13 RUBBISH AND WASTE MATERIALS

.1 Keep rubbish and waste materials at minimum quantities.

.2 Burning of rubbish is prohibited.

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

.4 Storage:

.1 Storage of oily waste shall be in approved receptacles to ensure maximum cleanliness and safety.

.2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove specified.

1.14 FLAMMABLE AND COMBUSTIBLE LIQUIDS

.1 Handle, store and use of flammable and combustible liquids in accordance with the National Fire Code of Canada.

.2 Keep flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Obtain written authorization from DCC Representative for storage of quantities of flammable and combustible liquids exceeding 45 litres.

.3 Do not transfer flammable or combustible liquids inside buildings or on jetties.

.4 Do not transfer flammable or combustible liquids in vicinity of open flames or any type of heat-producing devices.

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

.6 Store flammable and combustible waste liquids, for disposal, in approved containers located in safe ventilated area. Keep quantities to a minimum and notify DCC Representative when disposal is required.

.7 Use secondary containment vessels for all transfer of flammable or combustible materials.

.8 Report all spills to DCC Representative.

1.15 HOT WORKS

.1 The Contractor shall implement a hot works program in accordance with the National Fire Code of Canada and NFPA 51 Standard for Fire Prevention during Welding, Cutting and Other Hot Work.

.2 The Contractor shall obtain from the Base Fire Department a "Hot Work" permit for all hot works in the construction area. Frequency of renewal for hot works permits is at the discretion of the Base Fire Department.

.3 When Work is carried out in dangerous or hazardous areas involving use of heat, provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of the Base Fire Department.

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

.5 Area of hot works

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

.2 Where 1.16.5.1 is not possible,

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

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

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

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

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

.2 Sentence 1.16.5.2 shall apply for those areas.

.6 Protection of flammable and combustible materials

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

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

.2 Protected from ignition by non combustible materials.

.7 Fire extinguisher

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

1.16 CONFINED SPACE

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

1.17 HAZARDOUS SUBSTANCES

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

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

1.18 PARTIAL OCCUPANCY

.1 Implement partial occupancy procedures as defined in the drawings and specifications. Partial occupancy is where construction occurs adjacent to work areas occupied by Departmental or Canadian Forces personnel. This includes:

.1 Phased new construction.
.2 Early or partial occupancy of new construction.
.3 New construction being added onto an existing building.
.4 Renovation or recapitalization of an existing building.
.5 Phased renovation or recapitalization of an existing building.

.2 Where partial occupancy occurs, Contractor shall implement requirements as found in the drawings and specifications. This may include construction of a rated fire separation between occupied and construction areas as required by the National Fire Code.

.3 A watch, with tours at intervals of not less than one hour, shall be provided throughout demolition sites when there are occupants in the portion of the building not being demolished.

.4 Except where a building is provided with a fire alarm system or similar equipment, a watch, with tours at intervals of not more than one hour, shall be provided when a portion of the building is occupied while construction operations are taking place.

1.19 QUESTIONS AND/OR CLARIFICATION

.1 All questions or requests for clarification on Fire Safety in addition to above requirements shall be directed to the DCC Representative.

.2 DCC is responsible to obtain clarifications from the Base Fire Department. The Contractor is not to liaise directly with the Base Fire Department for notification,

authorization, other than Hot Work Permits, or any requests unless the situation constitutes an immediate emergency.

1.20 FIRE INSPECTION

.1 All site inspections by the Base Fire Department shall be coordinated through the DCC Representative.

.2 Allow the Base Fire Department unrestricted access to work site.

.3 Co-operate with the Base Fire Department during routine fire safety inspection of work site.

.4 Immediately remedy unsafe fire situations observed by the Base Fire Department.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Statutes of Canada 1999 Chapter 33. "Canadian Environmental Protection Act 1999".

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

.2 "Migratory Birds Convention Act, 1994"

.2 "Transportation of Dangerous Goods Act" and pursuant regulations.

.3 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (the Environment Canada "Refrigeration Code of Practice").

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

1.2 ADMINISTRATIVE

.1 Comply with all federal, provincial, and municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, including those referenced above.

.2 The Work Site is subject to inspection by the Base Environment Officer, or designate, or the DCC Representative, without prior notice.

.3 Failure to comply with environmental requirements may result in a stop work order or assessment of damages commensurate with repair of damage.

.4 The Contractor will be unable to request extra funding to meet environmental requirements.

.5 It is the Contractor's responsibility to be aware of environmental requirements and the best management practices and pollution control measures necessary to meet them.

.6 It is the Contractor's responsibility to obtain and abide by permits, licenses and compliance certificates at appropriate times and frequencies as required by the authorities having jurisdiction.

.7 Blasting is not permitted.

1.3 MIGRATORY BIRDS

.1 Prior to any outside work commencing, conduct visual inspection for any migratory bird nests on or adjacent to the work area. If found, do not disturb the nest and contact DCC Representative immediately.

1.4 FIRES

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

1.5 DISPOSAL OF WASTES

.1 Plan for the re-use, recycling, or disposal of all waste materials as per applicable legislation.

.2 Do not bury rubbish and waste materials on site unless approved by DCC Representative.

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

1.6 DRAINAGE

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

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Protect storm drains against entry by sediment, debris, oil, or chemicals.

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

1.7 POLLUTION CONTROL

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

.2 Control emissions from equipment and plant to conform to federal, provincial, and municipal requirements.

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

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

.5 Take all measures necessary to prevent material and mud tracking on adjacent roads and streets.

.1 Use mechanical sweepers as often as necessary to keep adjacent roads and streets clean of material and mud that is deposited from this project.

1.8 VEHICLE REFUELLING

.1 Refueling of vehicles or machinery is to be conducted above a secondary containment barrier.

1.9 SPILLS/LEAKS/RELEASES

.1 Establish a Spill Prevention and Response Plan.

.1 Ensure Spill Prevention and Response Plan identifies roles and responsibilities, contact information, waste disposal, and reporting.

.2 Maintain spill control equipment on-site adequate to control for one hour a liquid spill of 110% of any material brought on to or handled at the site.

.1 Requirement applies to sub-Contractors as well as the General Contractor.

.2 The minimum on-site spill response equipment is to include a spill kit in on-site vehicles and machinery, absorbent pads, granular absorbent, garbage bags and shovels.

.3 Spill Prevention and Response Plan is to include measures to escalate the response in the event of an emergency that exceeds on-site control capabilities.

.3 Response:

.1 In the event of a spill, invoke Contractor's Spill Prevention and Response Plan and make immediate notifications as per the Contractor Environmental Hazard and Spills Response Guide

.2 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.

.3 Damages caused to the natural environment by the Contractor's work crew (including sub-contractors) will be restored at the Contractor's own expense.

1.10 UNANTICIPATED SOIL CONTAMINATION

.1 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 prevention and response plan.

.4 Immediately contact the DCC Representative.

1.11 MERCURY THERMOSTATS AND SWITCHES

.1 Many thermostats and switches contain mercury, which must not be released to the environment.

.2 At a facility equipped to capture the mercury, recycle all surplus mercury-containing thermostats and switches that cannot be re-used.

1.12 WASTE MANAGEMENT AND DISPOSAL (WMD) PLAN

.1 Submit a Waste Management and Disposal (WMD) Plan to the DCC Representative before construction work begins at the site.

.2 The WMD Plan is to encompass:

.1 Regular waste,

.2 Construction waste,

.3 Hazardous materials used in the course of the work, and

.4 Hazardous materials and designated substance waste.

.3 The WMD Plan is to comply with legislation, best practices, and with the requirements of the specifications.

.4 Provide evidence in the WMD Plan that all proposed temporary storage procedures, transport methods, and disposal sites are licensed where applicable.

.1 Include copies of licenses.

.5 The WMD Plan is to include handling, storage, transportation, disposal, and emergency response.

.6 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.

.7 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Statutes of Canada 1999 Chapter 33. "Canadian Environmental Protection Act 1999"

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

.2 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (the Environment Canada "Refrigeration Code of Practice")

1.2 LEGISLATION COMPLIANCE

.1 Comply with all of:

.1 Federal Halocarbon Regulations 2022;

.2 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (the Environment Canada "Refrigeration Code of Practice") Report EPS 1/RA/2 March, 1996

1.3 DOCUMENTATION

.1 Installation, servicing, etc., only by, or under the supervision of, a technician licensed by the Province of Ontario, 313A or Red Seal, as a refrigeration mechanic ALSO in possession of an ODP certificate issued by the Heating, Refrigeration, and Air Conditioning Institute of Canada.

.1 Provide copies of all technicians' certificates to the DCC Representative.

.2 The following are the only halocarbons that are acceptable as new refrigerants (non-halocarbon refrigerants are also acceptable):

.1 R-448A

.2 Document all work—installation, maintenance, commissioning, decommissioning, leak testing etc.—on refrigeration and air conditioning systems in accordance with the 4CDTC Meaford BBSAI 1005 "Halocarbon and Ozone Depleting Substance Management" and "Halocarbon Data Sheet". Obtain the following DND form from the DCC Representative – ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG Mount white copy of form on equipment, supply Yellow & Pink copies to DCC Representative and retain Orange copy for records.

.3 Leak-test factory-charged halocarbon-containing equipment in accordance with the Refrigeration Code of Practice within one working day after delivery to the site, use DND form (ANNEX A3-7" REFRIGERATION AND AIR CONDITIONING SERVICE LOG) to document test. Supply Yellow & Pink copies to DCC Representative.

.4 After installation, leak-test both factory-charged and non-factory-charged halocarbon-containing equipment in accordance with the Refrigeration Code of Practice

.1 The DCC Representative will not issue the Interim Certificate of Completion until the equipment is documented to be leak-free, documentation must be on

approved DND form (ANNEX A3-7:REFRIGERATION AND AIR CONDITIONING SERVICE LOG) and Yellow & Pink copies have been supplied to DCC Representative.

.5 Conduct annual leak tests, on or before expiration of previous certificate date and record on DND form ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG, of halocarbon-containing equipment in accordance with the Federal Halocarbon Regulations, 2003 until such time as the Interim Certificate of Completion is issued.

1.4 HALOCARBON RELEASE REPORTING

.1 Immediately report all releases of halocarbons to the DCC Representative regardless of volume. Provide a worst case release volume **as well as** an anticipated release volume.

.2 Conduct an investigation, quantify the volume released, and provide a written record of the release within 5 days. The following forms can be obtained through the DCC representative:

.1 The DND form ANNEX A3-7: REFRIGERATION AND AIR CONDITIONING SERVICE LOG;

.2 The ANNEX B7-1: Halocarbon/Halon Release Report; and

.3 The responsible party should follow the "spill response plan" and phone 4CDTC alert room as soon as possible and provide them all relevant information about the spill (location, type of product, vehicle or equipment involved, entry into a water source, etc.

.3 The Contractor is responsible to report all applicable halocarbon releases to the appropriate authorities.

.4 Copies of all correspondence (including any follow-up) and reports related to a halocarbon releases are to be provided to DCC within 1 working day of transmission.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 91 00 Commissioning

1.2 DEFINITIONS

.1 **Quality Control (QC):** QC refers to the actual monitoring of specific project results to determine if they comply with relevant quality standards. There are a number of deliverables associated with the QC sub-system, most of these are generally already used on typical construction projects. The deliverables include, shop drawing reviews, on-site inspections and tests and related reports, site meeting minutes etc.

.2 **Quality Assurance (QA):** QA refers to the documented intent outlining the activities that are implemented in the QCP to provide confidence that the project will satisfy the relevant quality standards and specifications.

.3 **Quality Control Plan**: The Quality Control Plan (QCP) consists of the organizational structure and the inherent responsibilities, procedures, processes and resources needed to implement quality control management of the building process. In addition, and for the purpose of this project, "Commissioning" will be considered an integral element of the quality management system.

.1 The Contractor shall establish and maintain a documented QCP to ensure that the specified quality standards for the project are achieved, in compliance with the terms and conditions of the contract.

.2 Under the terms of the Contract, the Contractor is responsible for the delivery of a facility that meets the standards of quality demanded by the specification as it applies to the materials, workmanship, and completed results. The purpose of the QCP is to assist in the fulfillment of this obligation and to provide to the DCC Representative a means to confirm the specified level of quality will be achieved.

1.3 INSPECTION

.1 The Contractor must allow the DCC Representative access to Work site. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

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

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

.4 DCC Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, DCC Representative shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 The contractor to furnish and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Control (QC) testing in accordance with the contractor's quality control plan.

.2 DCC Representative will appoint and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Assurance (QA) testing.

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

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

.5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by DCC Representative at no cost to DCC Representative. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

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

.2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

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

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

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

1.7 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by DCC Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

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

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

1.8 REPORTS

.1 Submit electronic pdf format inspection and test reports to DCC Representative.

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

1.9 CONTRACTOR RESPONSIBILITIES

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

1.10 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.11 MILL TESTS

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

1.12 EQUIPMENT AND SYSTEMS

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

.2 Refer to Section 01 78 00 - Closeout Submittals for definitive requirements.

Part 2 (Not Used)

Part 3 (Not Used)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 DEWATERING

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

1.4 WATER SUPPLY

.1 Existing sources of water can be made available to the Contractor at no charge, subject to operational requirements. Arrange for connection and pay all costs for installation, maintenance and removal. Conversions or alterations to existing sources of water to meet construction requirements are the responsibility of the Contractor.

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

1.5 TEMPORARY HEATING AND VENTILATION

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

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

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

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

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

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

.4 Maintain temperatures of minimum 21 degrees C in all areas occupied by Owner if work occurs during heating season (October-May).

.5 Ventilating:

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

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

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

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

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

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

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

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

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

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

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

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

1.6 TEMPORARY POWER AND LIGHT

.1 Existing sources of electric power can be made available to the Contractor at the current Hydro One rates being charged to 4CDTC Meaford. Conversions or alterations to existing sources of electric power to meet construction requirements are the responsibility of the Contractor.

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

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

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

1.7 TEMPORARY COMMUNICATION FACILITIES

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

1.8 FIRE PROTECTION

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosure using Standard Leasable Temporary chain link fencing 2m x 3m (6'x10') sections. Provide one lockable truck gate. Maintain fence in good repair.

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

1.4 GUARD RAILS AND BARRICADES

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

.2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

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

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

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

1.6 DUST TIGHT SCREENS

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

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

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

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

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with DCC Representative locations and installation schedule 3 days prior to installation.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 QUALITY

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

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

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

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

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

1.3 AVAILABILITY

.1 Review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify DCC Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

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

1.4 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

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

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

1.5 TRANSPORTATION

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

.2 Transportation cost of products supplied by Owner will be paid for by DCC Representative. Contractor shall be responsible for the unloading, handling and storage of such products.

1.6 MANUFACTURER'S INSTRUCTIONS

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

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

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

1.7 QUALITY OF WORK

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

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

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

1.8 CO-ORDINATION

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

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

1.9 CONCEALMENT

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

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

1.10 REMEDIAL WORK

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

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

1.11 LOCATION OF FIXTURES

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

.2 Inform DCC Representative of conflicting installation. Install as directed.

1.12 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

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

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

1.13 FASTENINGS - EQUIPMENT

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

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

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

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

1.14 PROTECTION OF WORK IN PROGRESS

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

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

1.15 EXISTING UTILITIES

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

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submit to DCC Representative copies of the following documents, including updates issued:

- .1 Site-specific Health and Safety Plan prior to commencement of work on the work site.
- .2 Fire Safety Plan.
- .3 Reports or directions issued by authorities having jurisdiction, immediately upon issuance from that authority.
- .4 Accident or Incident Reports, within 24 hrs of occurrence.

.2 Submit other data, information and documentation upon request by the DCC Representative as stipulated elsewhere in this section.

1.2 COMPLIANCE REQUIREMENTS

.1 Comply with the latest edition of the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act.

.2 As a minimum, comply with the Canada Labour Code Part II Part 125(1)(l) and 125(1)(w), and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.

.3 A copy of the Canada Labour Code Part II may be obtained by contacting:

- .1 A condensed version can be viewed on-line at http://laws.justice.gc.ca/en/index.html

.4 Where the Base Health and Safety Program may stipulate more stringent requirements than identified in the Canada Labour Code Part II and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code, the DCC Representative shall provide the Contractor with the applicable excerpts from the Base Health and Safety Program.

.5 Observe and enforce construction safety measures required by:

- .1 National Building Code of Canada (latest edition).
- .2 Workplace Safety and Insurance Board of Ontario (WSIB).

.6 In event of conflict between any provisions of above authorities the most stringent provision shall apply. Should a dispute arise in determining the most stringent requirement, the DCC Representative shall advise on the course of action to be followed. In the case of direct conflict between the federal and provincial/territorial regulatory Health and Safety instruments noted above in paragraphs 1.2.1 and 1.2.2, the Canada Labour Code shall be the default regulatory instrument.

.7 Provide and maintain Workplace Safety and Insurance Board of Ontario (WSIB) coverage for all employees for the duration of the contract. Prior to commencement of the work, at the time of Interim Completion and prior to final payment, provide to the DCC Representative a certificate of Clearance from the Workplace Safety and Insurance Board of Ontario (WSIB) indicating that the Contractor's account is in good standing.

1.3 RESPONSIBILITY

.1 In accordance with the Canada Labour Code Part II, the obligations and responsibilities for safety reside with the Department of National Defence. The DCC Representative on behalf of the Department of National Defence will monitor safety on the Work Site in accordance with the Canada Labour Code Part II and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.

.2 Carry out work placing emphasis on health and safety of the public, building employees, site personnel and protection of the environment.

.3 The Contractor is responsible to enforce compliance by its employees and sub-contractors accessing the Work Site with safety requirements of Contract Documents, and all applicable federal, provincial, local statues, regulations, and ordinances.

.4 The Contractor is responsible to manage safety of the work site to ensure that any persons, including but not limited to, building employees and the general public circulating adjacent to the work operations are protected against harm due to the extent that they may be affected by conduct of the work.

.5 Contractors are required under the Canada Labour Code Part II to conduct site specific occupational health and safety meetings. For the purpose of this contract, the Contractor is responsible to establish and conduct site specific occupational health and safety meetings on a weekly basis.

.6 The Contractor is responsible to record and post minutes of all site specific occupational health and safety meetings in plain view on the work site. Make copies available to DCC Representative upon request.

.7 The Contractor is responsible to designate a competent person or persons to be present on site at all times during the work as the site health and safety representative. The designated person(s) shall be required to conduct regularly scheduled safety inspections of the work site as follows:

.1 Informal inspections on a minimum bi-weekly basis noting deficiencies and remedial actions taken in a log book or diary. Make the log book and/or diary available for the DCC Representative's viewing as requested.

.2 Formal inspections on a minimum weekly basis and is to provide a written report if requested to the DCC Representative for each formal inspection, document deficiencies, remedial action needed and assign responsibility for rectification to the appropriate party.

.8 The Contractor is responsible to ensure Contractor employees and sub-contractors accessing the work site are in possession of and wear appropriate personnel protective equipment (PPE).

.9 Daily or weekly field level hazard assessment shall be completed by the Contractor and communicated to all employees and occupant representative with the intent to identify known and potential hazards associated with current and future work tasks. The Contractor shall establish and implement control measures for known and potential hazards that have been identified.

.10 Should an unforeseen or peculiar safety related hazard or condition become evident during performance of work, the Contractor is responsible to immediately take measures to rectify the situation and prevent damage or harm and to advise the DCC Representative verbally and in writing of the hazard or condition.

1.4 SITE CONTROL AND ACCESS

.1 The Contractor shall be responsible after consultation with the DCC Representative to control all work site access points and work site activities.

.2 Delineation and isolation of the work site from adjacent and surrounding areas is not possible as the facility and infrastructure must remain fully operational and partially occupied and utilized by the Department of National Defence throughout the duration of the work of this contract. Refer to section 01 11 00 Summary of Work for further details on control of work site, working with occupants in the building and Fire Safety Plan submission requirements.

.3 On behalf of the Department of National Defence, Defence Construction Canada will be performing a safety monitoring function as required by the Canada Labour Code in order to verify that the Contractor is fulfilling all of the required responsibilities and duties as identified above. This monitoring function will be performed throughout the duration of the contract.

.4 Erect signage at access points and at other strategic locations around the work site clearly identifying the work site area(s) as being “off-limits” to non-authorized persons. Signage must be professionally made with well understood graphic symbols and is not to be used as advertising but for the specific use as related to site safety and key contact information.

.1 Information to be provided on the signage is as follows:

Project Name/Description:
Contractor Company Name:
Project Superintendent’s Name/Phone No.:
DCC Point of Contact Name/Phone No.:

1.5 FILING OF NOTICE

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

1.6 PERMITS

.1 Obtain permits, licenses and compliance certificates at appropriate times and frequencies as required by the authorities having jurisdiction.

.2 Post all permits, licenses and compliance certificates on work site and provide copies to the DCC Representative.

.3 Acquire a Hot Work Permit from DND/Base Fire Hall prior to commencing any cutting, welding, hot roofing or similar work.

.4 Acquire a digging permit from DND and complete permit prior to commencing any excavation work.

.5 Acquire a Confined Space Entry Permit from DND prior to entering any designated confined spaces.

.6 Acquire a Road Closure Permit from DND prior to commencing any Road Closures or similar work.

.7 Acquire a Fire Alarm Impairment Permit from DND prior to commencing any work which will affect the Fire alarm system.

1.7 PROJECT/SITE CONDITIONS

.1 The following are the known hazardous substances and/or hazardous conditions at the work site which shall be considered as health or environmental hazards and shall be properly managed should they be encountered as part of the work:

.1 There are no known hazardous substances and/or hazardous conditions exist at the work site. The DCC Representative shall provide the Designated Substance Survey report prior to the project commencing. Reports identifying the known hazardous substances are available for viewing from the DCC Representative.

.2 If suspected asbestos, mould, etc is discovered during the course of work the DCC Representative must be notified immediately.

.3 Due to the function of this building, hazardous/controlled materials (cleaning products) may be used in the daily work of the building occupant. Prior to starting work, the Contractor shall meet with the building occupant to become familiar with these materials.

.4 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 Obtain from the DCC Representative, a copy of the MSDS data sheets of the existing hazardous materials stored on site or being used by facility personnel in the course of their operations.

.3 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 the Contractor's site superintendent The DCC Representative will arrange to have the Contractor's site superintendent and designated site health and safety representative briefed on the specific content of the Base Health and Safety Program where it requires more stringent requirements than stipulated in the Canada Labour Code Part II and the Canada Occupational Safety and Health

Regulations made under Part II of the Canada Labour Code. DCC Representative will advise of time, date and location of the meeting and will be responsible for recording and distributing the minutes.

.2 The Contractor is responsible to conduct safety meetings as required by paragraph 1.3 above.

1.9 HEALTH AND SAFETY PROGRAM

.1 The Canada Labour Code Part II and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code provides the Contractor with the overall program of health and safety for operations on the Base. For the purpose of this contract, the Contractor shall perform a hazard assessment of the work site in order to acknowledge, assess and address the hazardous substances and/or hazardous conditions known and identified in paragraph 1.7, and to develop a written site-specific Health and Safety Plan as related to these known hazards. The Contractor shall be required to write the site-specific Health and Safety Plan for review by the DCC Representative, on behalf of the Department of National Defence. The site-specific Health and Safety Plan shall include provisions for an on-going hazard assessments performed during the progress of work identifying and documenting new or potential health risks and safety hazards not previously known and identified.

.2 The format of the site-specific Health and Safety Plan shall at a minimum for the purpose of this contract contain the following three (3) parts:

.1 Part 1: Detailed description of the project and a list of individual health risks and safety hazards identified by the contractor's detailed site specific hazard assessment(s).

.1 List of critical construction activities to be communicated with the DCC Representative which could affect facility, infrastructure, and occupant operations, or pose a risk to the health and safety of the occupants, Contractor employees and to the general public.

.2 Part 2: List of specific measures to control or mitigate each hazard and risk identified in part one of the Plan. Describe the Engineering controls, personnel protective equipment, safe work practices and any other applicable means to be implemented and followed when performing work related to each identified hazard or risk. Part 2 of the Plan must also include:

.1 In the management of safety responsibility, provide the name of the competent employee(s) assigned as site safety representative(s) who is (are) to be present on site at all times during work.

.2 A written statement, where applicable, that the Contractor has been made aware of known hazards and hazardous substances referred to under paragraph 1.7, and that the Contractor will inform all Contractor employees, sub-contractor employees and any persons affected or potentially affected by the work of this contract of the known hazards.

.3 A written statement confirming that Contractor employees, sub-contractors and other authorized persons accessing the work site are trained and have been fully instructed in:

.1 Safe operation of tools and equipment.

.2 Proper wearing and use of personnel protective equipment (PPE) as applicable to the purpose and activities to be conducted on site.

.3 Safe work practices and procedures to be followed during the performance of their given work tasks or function on the work site.

.4 Work site conditions and minimum site safety rules provided through safety orientation sessions.

.4 A copy of the Contractor's health and safety policy and disciplinary policy that will be followed to enforce compliance by Contractor employees and sub-contractors with safety requirements of contract documents, applicable regulations and the Contractor's site-specific Health and Safety Plan.

.3 Part 3: Emergency Measures and Communications Procedures as follows:

.1 Emergency Measures: On-site operating procedures, evacuation measures and emergency response to be implemented in the occurrence of an accident or incident. Procedures to be specific and relevant to identified hazards. Measures to complement and be integrated with the Facility Emergency Response Plan(s) in place at site.

.2 Confirmation of the location of nearest fire alarm activation box and telephone.

.3 A map depicting the location of the nearest emergency medical facility.

.4 The location of emergency equipment and supplies including but not limited to first aid kits, emergency eye wash stations, spill kits/equipment and fire extinguishers. Including confirmation that equipment and supplies have been verified/certified for use.

.5 The names of all persons assigned responsibility by the Contractor as a first aid attendant at the project.

.6 An inventory listing the common name of all controlled products (WHMIS Products) that the Contractor knows or intends to bring to the project site. List to be updated as necessary as project proceeds.

.7 A copy of the Contractor's accident/incident investigation policy and incident and accident report form(s) to be used by the Contractor to document any incident or accident that might occur during the course of project work

.8 Communication procedures:

.1 List of names and telephone numbers of designated official(s), to be contacted should an incident or emergency situation occur, including the following:

.1 Contractor and all sub-contractors.

.2 Federal and Provincial departments and local emergency resources organizations, as applicable to the hazards identified and type of accident or incident which might occur, in accordance with applicable laws and regulations.

.2 Procedures implemented at site to communicate and share information between Contractor employees, sub-contractors, and the Contractor on work site activities, and in particular those which might endanger employees and facility occupants and infrastructure users.

.3 The procedure to be followed by contract personnel to initiate emergency response by fire, police and medical personnel.

.4 Post a copy, including all updates, of the Health and Safety Plan in a common visible location at work site.

.3 Provide one copy of the site-specific Health and Safety Plan 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 both Canada Labour Code Part II and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code and the contract requirements related to the known hazardous substances and/or hazardous conditions.

.4 Provide and maintain one copy of the site-specific Health and Safety Plan at the work site, in a location that is easily accessible by all Contractor employees, sub-contractor employees and any persons affected or potentially affected by the work of this contract.

1.10 MINIMUM SITE SAFETY RULES

.1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements at the work site and obeyed by all persons accessing the work site:

.1 Wear PPE appropriate to the function and task while on the work site.

.2 Immediately report unsafe activities, conditions, near miss accidents, injuries and damages.

.3 Maintain the work site in a tidy condition.

.4 Obey warning signs and safety tags.

1.11 ACCIDENT REPORTING

.1 Investigate and report incidents and accidents as required by Canada Labour Code Part II and Ontario Occupational Safety and Health Act, and the Regulations made pursuant to the Act.

.2 For the purpose of this contract immediately investigate and provide a report to the DCC Representative on incidents and accidents that involve:

.1 A resulting injury that may or may not require medical aid but involves lost time at work by the injured person(s).

.2 Exposure to toxic chemicals or substances.

.3 Property damage.

.4 Interruption to adjacent and/or integral infrastructure operations with potential loss implications.

1.12 RECORDS ON SITE

.1 Maintain on site a copy of the safety documentation as specified in this section and any other safety related reports and documents issued to or received from the authorities having jurisdiction.

.2 Upon request, make copies available to the DCC Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 SUBMITTALS

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

.1 Structural integrity of any element of Project.
.2 Integrity of weather-exposed or moisture-resistant elements.
.3 Efficiency, maintenance, or safety of any operational element.
.4 Visual qualities of sight-exposed elements.

1.3 PREPARATION

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

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

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

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

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

1.4 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

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

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

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

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

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

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

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

.12 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Waste Management and Disposal Plan

.2 Project Cleanliness.

.3 Final cleaning.

1.2 WASTE MANAGEMENT AND DISPOSAL (WMD) PLAN

.1 Contractor to submit a waste management and disposal plan in accordance with Section 01 35 43 for approval by DCC Representative. Storage, transport and disposal of construction waste and debris to be in accordance with approved plan.

1.3 PROJECT CLEANLINESS

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

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

.3 Remove waste materials from site at regularly scheduled times or dispose of as directed by DCC Representative.

.4 Provide on-site containers for collection of waste materials and debris. Site plan must be submitted to DCC Representative prior to placement of containers.

.5 Do not burn waste materials on site.

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

.7 The work site must be left clean and tidy upon completion, to the satisfaction of the DCC Representative.

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

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

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

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

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

1.4 FINAL CLEANING

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

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

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

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

1.2 SUBMISSION

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

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

.1 Two (2) hard copies of the FINAL Operating and Maintenance Manuals.

.2 One (1) electronic copy (USB memory stick only) of the FINAL Operating and Maintenance Manual in PDF format. Files on USB memory stick shall be organized in same manner as the hard copies, and must follow the same formatting and sequence as specified in Article 1.3 and 1.4 of this section.

.3 Building will not be deemed ready for use, and the Final Certificate of Completion will not be granted, unless the Operating and Maintenance Manuals and the "As-built" Record Documents have been submitted and reviewed and accepted by the DCC Representative.

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

.5 If requested, furnish evidence as to type, source and quality of products provided.

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

.7 Pay costs of transportation.

1.3 FORMAT

.1 Organize data in the form of an instructional manual.

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

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

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

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

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

.7 Text: Manufacturer's printed data or typewritten data.

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

1.4 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 date of submission; names,

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

.3 schedule of products and systems, indexed to content of volume.

.2 For each product or system:

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

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

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

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

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

1.5 AS-BUILTS AND SAMPLES

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

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

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

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

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

.5 Keep record documents and samples available for inspection by DCC Representative.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of opaque drawings, provided by DCC Representative.

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

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

.1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.2 Field changes of dimension and detail.
.3 Changes made by change orders.
.4 Details not on original Contract Drawings.
.5 References to related shop drawings and modifications.

.4 Submit following drawings:

.1 Record changes in red. Mark on one set of prints and at completion of project prior to final inspection, produce electronic “as-built” records on disk using AutoCAD 2018. Annotate “AS-BUILT RECORD” in each drawing title block.
.2 Electronic "as-built" drawings shall be in accordance with all DND drawing standards. Copy of drawing standards can be downloaded at http://cafnet.dcc-cdc.gc.ca/CAD_BIM_GIS/access-eng.htm.
.3 All changes shall be shown on a separate drawing layer named "as-built".
.4 At least 2 weeks prior to scheduled commissioning activities, submit one copy of the DRAFT “As-built” Project Record Documents for DCC Representatives review and use during the commissioning activities. After the completion of the

commissioning activities, the DCC Representative will return to the Contractor the DRAFT copy, with review comments, for revision. Prior to the Issuance of the Final Certificate of Completion, and within 10 working days after the issuance of the Interim Certificate of Completion, submit 2 copies of the FINAL "As-built" Project Record Documents and disk of "as-built" record drawings.

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

1.7 EQUIPMENT AND SYSTEMS

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

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

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

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

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

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

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 00 - Commissioning.

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

1.8 MATERIALS AND FINISHES

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

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

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

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

1.9 SPARE PARTS

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

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

.3 Spare parts as identified in individual sections are to be delivered to the DCC Representative prior to the Contractor’s submission for Interim Certificate of Completion.

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

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

1.10 MAINTENANCE MATERIALS

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

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

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

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

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

1.11 SPECIAL TOOLS

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

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

.3 Special tools are to be delivered to the DCC Representative prior to the Contractor’s submission for Interim Certificate of Completion.

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

1.12 STORAGE, HANDLING AND PROTECTION

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

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

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

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

.5 Remove and replace damaged products at own expense and to satisfaction of DCC Representative.

1.13 WARRANTIES AND GUARANTEES

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

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

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

.4 Except for items put into use with DCC Representative's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and guarantees until time specified for submittal.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to DCC RP Ops personnel two weeks prior to date of final inspection.

.2 DCC RP Ops will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.4 SUBMITTALS

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

.2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

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

1.5 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

.2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 00 - Commissioning and equipment and systems are fully operational.

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

1.6 PREPARATION

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

.2 Verify that designated personnel are present.

1.7 DEMONSTRATION AND INSTRUCTIONS

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

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

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

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

1.8 TIME ALLOCATED FOR INSTRUCTIONS

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

.1 Section 23 - Cooling and Ventilation System: minimum eight (8) hours of instruction.

.2 Section 25 - Control System: minimum four (4) hours of instruction.

.3 Section 26 - Electrical System: minimum four (4) hours of instruction.

1.9 SYSTEMS TRAINING

.1 Identified training to be conducted in a classroom setting. Suitable classroom equipped with screen and/or projector and cable for VGA or HDMI connection to Contractor laptop connection to be provided by DND. Internet connection will NOT be provided, if required this will be Contractor responsibility via own ‘hotspot’.

.2 Turnover and Systems Seminar:

.1 Organize and conduct two day seminar to instruct the Owner representatives in the operation and general preventative maintenance of equipment and systems provided at the completion of the project.

.2 Provide services of qualified personnel, including each sub-trade and each major equipment supplier to attend seminar and instruct on his equipment or system. Seminar shall be chaired and conducted by the Contractor’s project manager.

.3 At seminar, submit final copies of record drawings and operating and maintenance manuals to Owner.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 General requirements for Commissioning facilities and facility systems.

1.2 QUALITY ASSURANCE

.1 Provide all related Commissioning and testing services.

.2 Comply with applicable procedures and standards.

.3 Perform services to support quality management and verifying contract performance.

1.3 REFERENCES

.1 CSA Z320 – Building Commissioning Standard

.2 ASHRAE Guideline 0-2019 – The Commissioning Process

.3 ASHRAE Standard 202-2018 – Commissioning Process for Building and Systems

1.4 METHODOLOGY

.1 Verification of performance of building systems and components will be performed by means of a Commissioning process.

.2 Commissioning plan & testing activities shall be performed by the Contractor and witnessed by the Commissioning Agent.

.3 Commissioning Agent for this facility will be the Consultant Commissioning Representative.

1.5 COMMISSIONING OBJECTIVES

.1 To bring mechanical, electrical & building architectural systems and components from a state of static completion to a state of dynamic operation.

.2 To verify conformance to contract requirements.

.3 To confirm installations, meet requirements of performance specification & design intent of contract drawings and specifications.

.4 To provide all testing documentation and records.

.5 To ensure completed facility meets user stated requirements.

.6 To provide a documented operator training program.

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

1.6 CONTRACTORS - COMMISSIONING PLAN

.1 Provide a commissioning plan consisting of:

- .1 Details regarding roles and responsibilities during all phases of Commissioning.
- .2 Documentation defining design assumptions and performance standards of proposed systems.
- .3 Description of mechanical, electrical and building architectural systems, intended operation and performance details.
- .4 Static testing and verification procedures.
- .5 Functional performance verification procedures.
- .6 Contractors and manufacturers start-up reports.
- .7 Check sheet documentation for recording testing procedures and recording test results prepared by the Contractor for mechanical, electrical and building architectural systems and components.
- .8 Test procedures and documentation for seasonal or deferred commissioning.
- .9 Training plan for building operators.
- .10 Final commissioning report.

1.7 COMMISSIONING AGENT'S RESPONSIBILITIES

.1 For ensuring that commissioning activities are carried out in accordance with the Contractor’s Commissioning plan.

.2 Commissioning Agent will:

- .1 Chair and arrange commissioning meetings.
- .2 Witness all equipment start-up and collect all manufacturer's start-up reports.
- .3 Witness testing and balancing measurements and procedures.
- .4 Witness all tests and initial all test documents at time of test.
- .5 Co-sign off, as witness, all systems verification and test forms.
- .6 Coordinate building operators training.
- .7 Arrange for provision of additional training where required.
- .8 Turn over completed Interim and Final Commissioning reports to the DCC Representative.

1.8 CONTRACTOR SUBMITTALS

.1 Prior to start of Work, submit name of Contractor personnel proposed to perform services to organize, coordinate, and schedule the applicable personnel to complete the Commissioning process.

.2 Submit documentation to confirm Contractor personnel compliance to perform services.

.3 Contractor shall prepare & submit a completed Commissioning Plan and Commissioning Schedule for review by DCC Represntative eight (8) weeks after award.

.4 Submit an updated Commissioning Schedule as directed by the Commissioning Agent.

.5 Prior to the Issuance of the Final Certificate of Completion, and within ten (10) working days after the issuance of the Interim Certificate of Completion, submit three (3) copies of the Interim Commissioning report in D-ring binders, complete with index tabs.

.6 Submit reports of Commissioning activities that are deferred or seasonal after completion and witnessing by the Commissioning Agent.

1.9 PROCEDURES - GENERAL

.1 Comply with referenced standards and the contract documents.

.2 Notify DCC Representative fourteen (14) days prior to beginning Commissioning activities.

.3 Accurately record data for each step on check sheets prepared by the Contractor.

.4 Report to Commissioning Agent / DCC Representative any deficiencies or defects found during start-up and the solution to resolve.

1.10 CONTRACTORS - RESPONSIBILITIES

.1 Prepare each system for testing and functional performance verification.

.2 Cooperate fully with the Commissioning Agent in the execution of the Contractors Commissioning plan. At completion of Commissioning, provide a written statement affirming that building systems are operating properly in accordance with requirements of performance specification and design intent of contract drawings and specifications.

.3 Provide personnel, equipment, instruments & operate systems as required to perform and record Commissioning activities as directed by the Commissioning Agent.

1.11 CONTRACTORS - PREPARATION

.1 Contractors personnel and equipment are on-site to complete the scheduled activities.

.2 All testing procedures & data recording check sheets are updated and on-site.

.3 Contractors & Manufacturers Start-up reports are updated and on-site.

.4 Updated Shop Drawings are on-site.

.5 Equipment Installation, Operation & Maintenance Manuals are on-site.

1.12 BUILDING SYSTEMS TO BE COMMISSIONED

.1 The Contractor shall provide Commissioning services for all mechanical, electrical & building architectural systems and components.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

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

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

.1 Safety Data Sheets (SDS).

.3 National Fire Code of Canada (2020).

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

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

1.2 DEFINITIONS

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

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

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

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

1.3 SUBMITTALS

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

.2 Product Data:

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

.1 Submit to DCC Representative current Safety Data Sheet (SDS) for each hazardous material required prior to bringing hazardous material on site.

.2 Submit hazardous materials management plan to DCC Representative that identifies hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements

1.4 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

.4 Segregate incompatible materials and wastes.

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

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

.7 Maintain clear egress from storage area.

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

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

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

.11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.12 Report spills or accidents immediately to DCC Representative. Submit a written spill report to DCC Representative within 24 hours of incident.

1.5 TRANSPORTATION

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

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

.3 If hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with DCC Representative.

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

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

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

.5 Label container(s) with legible, visible safety marks as prescribed by federal and provincial regulations.

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

.7 Provide photocopy of shipping documents and waste manifests to DCC Representative.

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

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

Part 2 Products

2.1 MATERIALS

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

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

Part 3 Execution

3.1 DISPOSAL

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

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

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

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

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

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

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

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

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 06 08 99 - Rough Carpentry for Minor Works

1.2 DEFINITIONS

.1 Abbreviations: The following abbreviations are used in this Section and are consistent with definitions in CAN/CSA-O80 Series.

- .1 chromated copper arsenate (CCA)
- .2 alkaline copper quaternary (ACQ)
- .3 copper azole (CA)
- .4 micronized copper azole (MCA)

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

- .1 ASTM A 123/A 123M-21 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A 153/A 153M-16a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A 480/A 480M-22a Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .4 ASTM A 653/A 653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .5 ASTM A 1003/A 1003M-15, Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
- .6 ASTM F 593-17, Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
- .7 ASTM F 1428-92(2017), Standard Specification for Aluminum Particle-Filled Basecoat/Organic or Inorganic Topcoat Corrosion Protective Coatings for Fasteners
- .8 ASTM F 1667-21a, Standard Specification for Driven Fasteners: Nails, Spikes and Staples
- .9 ASTM F 2329/F 2329M-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/G40.21-18, 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 (2022)

.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-S102.2:2018, 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 M4-21, Standard for the Care of Preservative-Treated Wood Products

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Before starting any work of this Section, coordinate with wood products listed in Article 1.4, Related Requirements of the Wood Treatment Reference Guide for allowable wood species, grade and usage.

.1 Obtain products only from certified pressure treating facilities listed in the current version of Canadian Wood Preservation Certification Authority (CWCPA) Environmental Plant Certification Program.

.2 Use only products listed in WPC-04 and that are registered with PMRA Pesticide Information Database.

1.5 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 based on Use Categories (UC) described in Paragraph 2.2.2 below and types of wood preservative treatment materials used for the Project

.2 Wood Treatment Certificates - submit information for wood preservative 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.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Carried out in accordance with Section 01 61 00 - Common Product Requirements, Section 06 08 99 - Rough Carpentry for Minor Worksa, AWPA 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.

1.7 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.

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 2.5µm per year.

.2 Preservative Solvents: Use waterborne preservative treatments required by Use Categories described above and generally as follows:

.1 Water Based Solvents:

.1 wood in contact with waterproofing membranes (confirm compatibility with membrane manufacturer before installation).

2.3 MATERIALS

.1 Wood Products: Coordinate with the following for species, grade and quality requirements:

.1 Dimensional Lumber: refer to Section 06 08 99 - Rough Carpentry for Minor Works

.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 F 1667 ,applicable to Use Categories described in Paragraph 2.2.2 above and wood preservative 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 treatment materials used for the project as follows:

.1 Stainless Steel Fastenings: Fastenings manufactured using stainless steel, Type 304 or 316 meeting requirements of ASTM F 593 .

.2 Galvanized Steel Fastenings: Fastenings meeting requirements of ASTM F 2329/F 2329M , having hot-dipped galvanized coating in accordance with ASTM A 153/A 153M , Class C and D.

.3 Coated Steel Fastenings: Fastenings meeting requirements of ASTM F 2329/F 2329M , having corrosion protective coating in accordance with ASTM F 1428 , Grade 4A or 4B.

2.4 PRESSURE TREATED MATERIALS

.1 Preservative Treatments: Use the following pressure preservative treatments based on regional availability:

.1 Exterior structural, above-ground, low potential for human contact: Use CCA, ACZA, PCP or CR wood treatments

2.5 ACCESSORIES

.1 Surface Applied Treatments: Wood treatments specific for application to machined and cut ends, or drilled surfaces meeting the requirements of CAN/CSA-O80 , and in accordance with AWPA M4.

Part 3 Execution

3.1 INSTALLATION

.1 Dimensional Lumber: Incorporate treated wood products into construction as described in Section 06 08 99 - Rough Carpentry for Minor Works and as depicted on drawings.

.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 AWPA M4 , and in accordance with treatment manufacturer's written instructions.

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

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 05 73 - Wood Treatment

1.2 REFERENCE STANDARDS

.1 ASME International (ASME):

.1 ASME B18.6.1- 1981(R2016), Wood Screws (Inch Series)

.2 ASTM International (ASTM):

.1 ASTM A 307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

.2 ASTM C 954 22, 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 D 7612-21, Standard Practice for Categorizing Wood and Wood-Based Products According to their Fiber Sources

.4 ASTM F 1667-21, Standard Specification for Driven Fasteners: Nails, Spikes and Staples

.3 CSA Group (CSA)

.1 CSA O86 Consolidation-14, Engineering Design in Wood

.2 CSA O141.05 (R2019), Softwood Lumber.

.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 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 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 Delivery and Acceptance Requirements: Protect materials from weather while in transit and on the jobsite.

.2 Storage and Handling Requirements:

.1 Store materials at least 150 mm above the ground on pallets or blocks

.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

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

2.2 PERFORMANCE CRITERIA

.1 Lumber Grades: Provide lumber products as described in Paragraph 2.1.1.1 in accordance with Regulatory Requirements.

2.3 MATERIALS

.1 Pressure Preservative Treated Wood (PPTW): Preservative treatment of dimensional lumber, refer to Section 06 05 73 - Wood Treatment

2.4 ACCESSORIES

.1 Driven Fasteners - steel nails, spikes, brads and staples meeting requirements of ASTM F 1667 :

.1 Ensure length is sufficient to penetrate connecting solid wood materials

.2 Pressure treated materials: refer to Section 06 05 73 - Wood Treatment

.2 Rough Hadware: manufacturer recommended fastening devices and anchors, including bolts, nuts, and washers meeting requirements of ASTM A 307 :

.1 Pressure treated materials: refer to Section 06 05 73 - Wood Treatment

.3 Wood Screws - use steel screws meeting requirements of ASME B18.6 :

.1 Exterior work: galvanized, ceramic coated or stainless steel

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for rough carpentry 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 [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.

3.3 INSTALLATION

.1 Roof sleepers:

.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 roof sleeper supports as required and attach to other construction

3.4 CLEANING

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

.1 Leave Work area clean at end of each day

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

End of Section

PART 1 GENERAL

1.1 RELATED WORK

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 61 00 - Common Product Requirements.

.4 Section 01 74 00 - Cleaning.

.5 Section 01 78 00 - Closeout Submittals.

.6 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM C 1177/C1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .2 ASTM C 1289-22, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .3 ASTM C 1549-16(2022), Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
- .4 ASTM D 638-14, Standard Test Method for Tensile Properties of Plastics.
- .5 ASTM D 1004-21, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
- .6 ASTM D 6878/D 6878M-21, Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.

.2 Canadian General Standards Board (CGSB).

- .1 CAN/CGSB - 51.33-M89 Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.3 Canadian Roofing Contractor’s Association (CRCA)

- .1 CRCA Specification Manual.

.4 Underwriters Laboratories’ of Canada (ULC)

- .1 CAN/ULC-S701.1:2017, Standard for Thermal Insulation, Polystyrene Boards.
- .2 CAN/ULC-S702.2:2015, Standard for Mineral Fibre Thermal Insulation for Buildings.
- .3 CAN/ULC-S704.1:2017, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 SUBMITTALS

.1 Product Data

.1 Provide membrane manufacturer's printed data to show that all components of roofing system comply with the specified requirements. Include data for each product used in conjunction with roofing membrane.

.2 Provide documentation to show the roofing system complies with the wind uplift performance requirements.

.2 Shop Drawings

.1 Provide manufacturer's drawings showing layout, details of construction, identification of materials, membrane fastener pattern and spacing, membrane penetration details.

.2 Indicate in shop drawings flashings and all required roofing materials.

.3 Submit manufacturer's certification letter stating the contractor is an authorized installer of the manufacturer's roofing system.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00 - Common Product Requirements for storage and handling requirements.

.2 Deliver roofing materials to site in original, sealed containers with manufacturer's name, brand name and installation instructions intact and legible.

.3 Store materials off-ground in weatherproof storage.

.4 Store materials in upright position. Store membrane rolls with selvage edge up, store as per manufacturer's requirements to meet warranty.

.5 Remove only in quantities required for same day use.

.6 Place plywood runways over work to protect work and enable work flow.

.7 Store adhesives and sealants between 15°C and 25°C. If exposed to lower temperature, restore to 15°C minimum temperature before using.

.8 Store insulation protected from daylight, weather and deleterious materials.

1.5 COMPATIBILITY

.1 Compatibility between components of roofing system is essential. Provide written declaration to Owner stating that materials and components, as assembled in system, meet this requirement.

1.6 QUALITY ASSURANCE

.1 Provide certificate signed by roofing manufacturer verifying that installer is approved, authorized and/or licensed by manufacturer to install specified products and is eligible to obtain the specified warranty of the section.

.2 Refer to Section 01 33 00 – Submittal Procedures and Section 01 45 00 - Quality Control for submission procedures.

1.7 JOB CONDITIONS

.1 When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

.2 Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommendations. Install roofing only dry conditions and forecasted weather conditions.

.3 Proceed with work so new roofing materials are not subject to construction traffic. When necessary, provide protection for new roof sections. Inspect upon completion for possible damage.

.4 Surfaces on which the roofing components (insulation, roofing membranes) is to be applied shall be clean, smooth, dry and free from projections or contaminations.

.5 New roofing shall be complete and weathertight at the end of the work day.

.6 Contaminates such as grease, fats, and oils shall not be allowed to come in direct contact with the roofing membrane.

1.8 WARRANTY

.1 Provide a written guarantee signed and issued in the name of The Owner by the Roofing System Manufacturer stating that roofing system is free from manufacturing defects and that the system will stay in place and remain leak proof for a period of twenty (20) years from date of Substantial Certificate of Completion, subject to the standard limitations and conditions of the manufacturer.

.2 Provide a written guarantee, signed and issued in the name of the Owner by the Contractor, stating that the roofing application has been performed in compliance with the plans and specifications, and for two (2) years from the date of Substantial Certificate of Completion, the Contractor shall repair, at no expense to the Owner, any defects which result of a failure to comply with the plans and specifications.

.3 Defective work shall include, but not limited to: leaking, wind uplift, delamination of roofing materials, reduction of thermal value due to moisture in insulation, crazing and ridging.

.4 Warranty to be non-prorated.

PART 2 PRODUCTS

2.1 DECK COVER AND AIR/VAPOUR BARRIER

.1 Deck Cover: Pre-primed glass mat faced gypsum panel non-asphaltic, highly filled proprietary heat-cured coating on one side, to ASTM C1177, 12.7 mm thick.

.2 Air/Vapour Barrier: Self adhering peel and stick air/vapour barrier composed of rubberized asphalt laminated to woven polypropylene film, minimum thickness 1.0 mm.

2.2 INSULATION AND COVER BOARD COMPONENTS

.1 Polyisocyanurate Insulation:

.1 To CAN/ULC-S704, glass reinforced felt facers, square edged and containing no CFC.

.2 Insulation value thickness per cm based on values listed in the latest edition of NRC - Evaluation Listings.

.3 Provide two layers of insulation installed with staggered joints.

.2 Total assembly RSI value:

.1 Minimum average RSI value of assembly insulation components to be 4.0. Insulation assembly components to consist of thermal barrier, insulation and cover board.

2.3 INSULATION COVER BOARD

.1 Nonstructural, glass mat faced gypsum panel with water-resistant core to ASTM C1177, 6.35 mm thick.

2.4 TPO MEMBRANE MATERIALS

.1 Thermoplastic Polyolefin (TPO) Membrane:

.1 To ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric backed TPO sheet, minimum 2.0 mm nominal thickness. Colour, White.

.2 TPO membrane properties:

.1 Breaking Strength: minimum 1.9 kN.

.2 Elongation of Reinforcement Break: 25%.

.3 Tearing Strength: minimum 530 N.

.4 Brittleness Point: Pass.

.5 Ozone Resistance: Pass.

.6 Water Absorption Resistance: < 3%.

.7 Puncture Resistance: minimum 450 kN.

.8 Sheet size: 2.4 m x 30 m.

.3 TPO Radiative properties (Initial/3 Years):

.1 Solar Reflectance (CRRC): minimum 0.34/0.34

.2 Thermal Emittance (CRRC): minimum 0.89/0.88

.3 Solar Reflectance Index (SRI): minimum 37/36

.4 Install contrasting colour TPO sheet, minimum 1.8 m wide, along the entire perimeter of all roof sections. Colour to be as per Owner selection from manufacturer's standard colour range.

2.5 SHEET FLASHING

.1 Manufacturer's standard unreinforced TPO sheet flashing, minimum 1.4 mm thick, same colour as TPO membrane sheet.

2.6 MEMBRANE ADHESIVES

.1 High strength, solvent based synthetic rubber adhesive.

2.7 FASTENERS

.1 Fasteners: minimum #14 mechanical fasteners made of case-hardened carbon steel with corrosion resistance coating, complying with FM standards. 75 mm diameter round or hexagon stress plates complying with CSA B35.3 and FM 4470 approval standards, diameter and lengths as required to suit total assembly thickness. Ensure fasteners have the following deck penetration:

.1 For metal decks: minimum 19 mm and maximum 25 mm longer than assembly being secured. Fasteners to engage metal deck top flange. At gymnasium locations, fastener points of all fasteners to be removed.

.2 Insulation and cover boards adhesive: single-component, moisture cured, solvent free polyurethane adhesive, dispensed from a portable disposable pre-pressurized container.

PART 3 EXECUTION

3.1 WORKMANSHIP

.1 Do roofing work in accordance with applicable, standard in Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual, except where specified otherwise.

.2 Comply with manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.

.3 Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

.4 Install roofing membrane only when surfaces are clean, dry, smooth and free of snow, ice. Do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application.

3.2 PROTECTION

.1 Cover walls and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of work.

.3 Clean off drips and smears of adhesive material immediately.

.4 Protect roof from traffic and damage.

.5 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.

.6 Install insulation promptly to avoid possibility of condensation beneath vapour retarder.

.7 Take necessary measures ensuring no penetration of the elements will occur to the building after commencement of work, including but not limited to water.

.8 Only remove quantities of existing roofing material and install quantities of new roofing materials per day that can be covered with waterproofing membranes.

3.3 MEMBRANE ROOFING APPLICATION (METAL ROOF DECK)

.1 Insulation and Cover Board:

- .1 Selectively patch insulation and cover board at redundant roof penetration location. Thickness to match existing such that upper surface of patch is flush with adjacent roof.
- .2 Above insulation patch to be securely backed at roof deck.

.2 Membrane Placement and Attachment

- .1 Fully Adhered System:
  - .1 Unroll membranes and allow to relax for installing.
  - .2 Layout the membrane pieces so that the field and flashing splices are installed to shed water.
  - .3 Apply membrane adhesive to the underside of the membrane and the corresponding substrate at rates required by the manufacturer. Do not apply adhesive to the splice edge of the membrane.
  - .4 Allow adhesive to set as per the adhesive manufacturer's instructions.
  - .5 Roll coated membrane unto coated substrate, avoiding wrinkles. Brush down bonded section of membrane into adhesive with a soft bristle push broom to achieve maximum contact.
  - .6 Clean seam areas, overlap roof membrane and hot-air weld all side and end laps of roofing membrane and sheet flashings, to ensure a watertight seam installation.
- .2 Mechanically Fastened System:
  - .1 Unroll membranes and allow to relax for installing.

.2 Install roof membrane with the long dimension perpendicular to steel roof deck flutes.

.3 Align roof membranes and maintain uniform side and end laps of minimum dimensions required by the manufacturer. Stagger end laps.

.4 Mechanically fasten roof membrane securely at terminations, penetrations and perimeter of roofing.

.5 Apply roof membrane with side laps shingles with slope of roof deck where possible.

.6 Secure on edge of the roofing membrane using fasteners and fastener plates centred within the seam, mechanically fastened to the roof deck.

.7 Clean seam areas, overlap roof membrane and hot-air weld all side and end laps of roofing membrane and sheet flashings, to ensure a watertight seam installation.

.3 Flashings:

.1 Install sheet flashing the same day as roofing membrane. Adhere to substrates in accordance with roofing manufacturer's written instructions.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section specifies fire stop and smoke seal systems and materials used in or around items which fully or partially penetrate a fire separation, to restrict the spread of fire and smoke thus maintaining the integrity of a fire separation.

.2 This Section includes requirements for:

.1 Through-penetration fire stops:

.1 For openings created to allow a penetrating item such as piping, conduits, raceways, ducts, cable trays, cables, tubing or structural components to pass completely through a fire separation or fire-resistance rated assembly.

.3 This Section includes fire stopping and smoke seal work for the entire Project including selection, installation and inspection of all required fire stops.

1.2 DEFINITIONS

.1 Fire Blocking: materials, components or system installed in a concealed space in the building to restrict the spread of fire and smoke in that concealed space or from that concealed space to an adjacent space.

.2 Fire Compartment: spaces within a building that are enclosed by exterior walls or separated from other parts of the building by enclosing Fire Separations having a Fire-Resistance Rating.

.3 Fire-Resistance Rating: time in minutes or hours that a material or assembly of materials will withstand the passage of flame and transmission of heat when exposed to fire, meeting the requirements of CAN/ULC-S101 or as determined by formal testing of material or assembly of materials, meeting requirements of CAN/ULC-S115, or an interpretation of information derived from formal testing in accordance with requirements of the Building Code and acceptable to the Authority Having Jurisdiction (AHJ).

.4 Fire Separation: assembly that acts as a barrier against the spread of fire, smoke and noxious gases resulting from combustion as defined by the Building Code and includes the following assemblies having a Fire-Resistance Rating requiring Fire Stopping as follows:

.1 Penetration-Type Fire Stop systems located within loadbearing walls and partitions.

.2 Penetration-Type Fire Stop systems located within non-loadbearing walls and partitions.

.3 Penetration-Type located within floor assemblies.

.5 Fire Stop: material, component or system, and its means of support, used to protect gaps between fire separations, between fire separations and other construction assemblies, or used in openings where penetrating items wholly or partially penetrate fire separations, to restrict the spread of fire and smoke thus maintaining the fire-resistance continuity of a fire separation.

.6 Fire Stop System: a specific site erected construction consisting of the assembly, fire stop materials, any penetrating items and their means of support which have met the requirements for an F, FT, FH, FTH and/or L rating when tested in a fire-resistance rated assembly in accordance with CAN/ULC-S115.

.1 F-Rating: the amount of time a fire stop system can remain in place without the passage of flame through the opening or the occurrence of flaming on the unexposed face of the fire stop.

.2 FT-Rating: a fire stop system with an F-Rating for the required time period which can also resists the transmission of heat through the fire stop during the same period and limit the rise in temperature on the unexposed face and/or penetrating item of the fire stop.

.3 FH-Rating: a fire stop system with an F-Rating for the required time period which can also resist the force of a hose stream without developing openings for a prescribed period.

.4 FTH-Rating: a fire stop system with an FT-Rating for the required time period which also passes the hose stream test for a prescribed period.

.5 L-Rating: largest test sample leakage rate, determined in accordance with the optional air leakage test in CAN/ULC-S115.

.7 Multi-penetration: two or more service penetrations through an opening in the fire separation.

.8 Non-rated Fire Separation: fire separation acting as a barrier to the spread of smoke until a response is initiated such as the activation of a fire suppression system.

.9 Single-penetration: single service penetration through an opening in the fire separation.

.10 System Design Listing: document providing proof of testing with technical details, specifications and requirements that leads to the application of a specific listed fire stop system.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM A 1008/A 1008M-21 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable

.2 ASTM C 719-22, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

.3 ASTM C 920-18, Standard Specification for Elastomeric Joint Sealants

.4 ASTM E 84-21, Standard Test Method for Surface Burning Characteristics of Building Materials

.5 ASTM E 119-20, Standard Test Methods for Fire Tests of Building Construction and Materials

.6 ASTM E 136-19A, Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 degrees

.7 ASTM E 595-21, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment

.8 ASTM E 814-13a (2017), Standard Test Method for Fire Tests of Penetration Firestop Systems

.9 ASTM E 1966 15, Standard Test Method for Fire Resistive Joint Systems

.10 ASTM E 2032-21, Standard Guide for Extension of Data From Fire Resistance Tests Conducted in Accordance with ASTM E 119.

.11 ASTM E 2174-20A, Standard Practice for On-Site Inspection of Installed Firestops.

.2 Firestop Contractors International Association (FCIA):

.1 FCIA Firestop Manual of Practice, 8th Edition 2023

.3 Factory Mutual Approvals (FM):

.1 FM 4990-2009, Approval Standard for Fire stopping

.2 FM 4991-2013, Approval Standard for Firestop Contractors

.4 International Accreditation Service (IAS):

.1 IAS AC291-19, Accreditation Criteria for Special Inspection Agencies

.5 International Firestop Council (IFC)

.1 IFC Guidelines for Evaluating Engineering Judgments

.2 IFC Guidelines for Evaluating Engineering Judgments - Perimeter Fire Barrier Systems

.3 IFC Inspection Guidelines for Penetration Firestop Systems and Fire Resistive Joint Systems in Fire Resistance Rated Construction, 5th Edition

.6 National Research Council Canada (NRC):

.1 National Building Code of Canada (NBC) 2020

.2 Best Practice Guide on Fire Stops and Fire Blocks and Their Impact on Sound Transmission 2007

.7 ULC Standards (ULC):

.1 CAN/ULC-S101-14, Standard Method of Fire Endurance Tests of Building Construction and Materials

.2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.3 CAN/ULC-S114-18, Standard Method of Test for Determination of Non-Combustibility in Building Materials

.4 CAN/ULC-S115-18, Standard Method of Fire Tests of Firestop Systems

.8 Underwriters Laboratories Inc. (UL):

.1 UL 1479-2015, Fire Tests of Penetration Firestops

.2 UL Qualified Firestop Contractor Program

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Hold pre-installation meeting one week before beginning Work of this Section, with Contractor, Subcontractor and DCC Representative to:

.1 Verify Project requirements.

.2 Review sustainable requirements.

.3 Review installation and substrate conditions.

.4 Discuss coordination with other Subcontractors.

.5 Review system design listings, manufacturer's installation instructions and warranty requirements.

.6 Review quantity and location of mock-ups.

.2 Hold pre-installation meetings with other trades to review:

.1 Installation procedures and precautions.

.2 Location, scheduling and sequencing of other work around fire stops that can affect the outcome of the installation.

.3 Requirements for annular opening sizes.

.4 Requirements and preparations for wall/floor single and multi-penetrations.

.5 Requirements for construction and perimeter joints.

.3 Submit copies of applicable listed fire stop system details to each trade for opening preparation. Include installation details required for the listed system.

.4 Meeting minutes: Contractor to take minutes of pre-installation meetings and distribute to DCC Representative, Consultant and each affected trade.

.2 Sequencing:

.1 Proceed with installation only when submittals have been reviewed by Consultant.

.2 Pipe insulation: Certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Qualification Statement:

.1 Submit contractor qualification statements and certificates demonstrating compliance with the qualification requirements of this Section, as described in PART 1 - QUALITY ASSURANCE, within ten (10) working days after award of contract and before starting Work.

.3 Product Data:

.1 Submit manufacturer's product data for each type of fire stopping. Submit complete product data for each individual component and include:

.1 Product name and product number

.2 Product characteristics and performance criteria

.3 Physical size, finish and limitations

.4 Technical data on out-gassing, off-gassing and age testing

.5 Curing time

.6 Chemical compatibility to other construction materials

.7 Shelf life

.8 Life expectancy

.9 Temperature range for installation

.10 Humidity range for installation

.11 Sound attenuation STC-Rating

.2 Manufacture Product Certification:

.1 Submit manufacturer certification certifying products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOC's) and are non-toxic to building occupants.

.2 Submit test reports showing compliance to ASTM E 595.

.3 Submit one copy of WHMIS Safety Data Sheets (SDS) for each individual component in accordance with Section 02 81 01 - Hazardous Materials

.4 Submit a comprehensive list of all products and components included in submittal.

.4 Shop Drawings:

.1 Submit shop drawings showing system design listings for Project including proposed materials, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details to accurately reflect actual job conditions for each product and assembly.

.3 Submit details for materials and prefabricated devices.

.4 Submit electronic copy of shop drawings and include:

.1 Title page, labelled "Fire and Smoke Stop System Listings". Include project name, date and the names of the installation company and the manufacturer of proposed products.

.2 Table of Contents.

.3 List of each proposed listed fire stop system and corresponding service penetration type or joint type in a matrix spreadsheet schedule, indicating floor and wall system, including rating for each.

.4 System Design Listings:

.1 Submit design listings for each listed fire stop system and each application identified in accordance with CAN/ULC-S115

.2 When more than one product is specified for the listed fire stop system or more than one packing/damming material is indicated, identify the item that will be used on this Project.

.5 Certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Location of penetrations:

.1 Drawings showing the location of each penetration with a unique penetration identification number and associated listing number

.2 Schedules listing each penetration with a unique identification number, their associated listing number, organized by floor, wall and ceiling area and indicating each room number.

.5 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.6 Quality Assurance Submittals: Submit the following in accordance with Section 01 45 00 - Quality Control:

.1 Test reports in accordance with CAN/ULC-S101, CAN/ULC-S102, and CAN/ULC-S115.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Document from Engineer of Record showing compliance of alternative fire stopping solution with CAN/ULC-S115 and the EJ guidelines provided by the National Research Council, Best Practice Guide on Fire Stops and Fire Blocks and Their Impact on Sound Transmission.

.3 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.5 Manufacturer's Site Reports: Submit manufacturer's reports within three days of review, verifying compliance of Work, as described in SITE QUALITY CONTROL in Part 3 of this Section.

.7 Engineering Judgments(EJ):

.1 Where there is no specific tested listed fire stop system available from the manufacturer for a particular fire stop configuration, review systems from other manufacturers to obtain a listed fire stop system.

.2 Submit an EJ from the system manufacturer if there are no listed systems available from other manufacturers.

.3 Prepare and submit an EJ in accordance with best practices established in the following documents:

.1 IFC Guidelines for Evaluating Engineering Judgments.

.4 For each EJ submitted, include:

.1 Project name, number and location.

.2 A description of the proposed system with detailed drawing.

.3 Installation instructions.

.4 Complete descriptions of critical elements for the fire stop configuration.

.5 Copies of all referenced system design listings which EJ is based on.

.6 EJ issuer name and contact information.

.7 Date of issue of EJ with authorization signature of issuer.

.5 EJ shall only be issued by fire stop manufacturer's qualified technical personnel or in collaboration with the manufacturer by a knowledgeable registered Professional Engineer, a Fire Protection Engineer or an independent testing agency that provides testing and listing services for fire stop systems similar to the EJ being contemplated.

.6 EJ shall be based upon interpolations of previously tested fire stop systems that are either sufficiently similar in nature or clearly bracket the conditions upon which the EJ is to be given. Additional knowledge and technical interpretations based upon accepted engineering principles, fire science and fire testing guidelines (e.g., ASTM E 2032) may also be used as further support data.

.7 EJ shall be based upon knowledge of the elements of the construction to be protected and understanding of the probable behaviour of that construction and the recommended fire stop system protecting it were they to be subjected to the adequate standard fire test method for the required fire rating duration.

.8 EJ shall be limited to the specific conditions and configurations for which it was created and should be based upon reasonable performance expectations for the recommended fire stop system under those conditions.

.9 EJ shall be accepted only for a single specific job and location and should not be transferred to any other job or location without thorough and appropriate review of all aspects of the next job or location's circumstances.

.1 Manufacturer letter stating their opinion, with supporting justification, that the EJ will perform as a fire stop system when subjected to the appropriate standard fire test method for the required fire rating duration.

.10 Once the EJ has been reviewed, submit to the AHJ for final approval.

.8 Closeout Submittals:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.9 Operation and Maintenance Data: Submit maintenance data for incorporation into manual, including:

.1 WHMIS Safety Data Sheets (SDS),

.2 product data and manufacturer's installation and maintenance instructions for each product/system used on this project,

.3 approved system design listings and EJs, and

.4 matrix schedule listing all system design listings and EJs with a description of their penetration or joint type.

.5 Certifications:

.1 Provide proof of training for each worker that performed installation on the Project.

.2 Accreditation of third-party inspection firm.

.6 Manufacturer's field reports.

.7 Warranty information on fire stop installations.

.8 Life expectancy of each product installed as part of Project. For each system, list the installation date of products and the expected expiration date (month/year).

.10 Record Documentation:

.1 Maintain a daily log of all activities on site during the course of construction. Submit a copy of all daily logs after completion of fire stopping work.

.2 As-built Drawings:

.1 Submit a marked-up set of Drawings to provide referencing system identifying the location of each fire stop.

.2 Identify each penetration type fire stop with their penetration identification number.

.3 Provide detailed Drawings of system design listings for each type of fire stop (i.e., through-penetration, membrane penetration, blank opening, construction joint, building perimeter).

.4 Fire Stop Schedules:

.1 Submit complete fire stop schedules for floors, walls and ceilings.

.2 Indicate all penetration fire stops and joint fire stops through each reference wall, floor and ceiling in the schedules.

.3 Cross-reference firestop schedules with as-built drawings and indicate design listing numbers associated to each penetration fire stop and joint fire stop.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Use materials and methods of determining required thickness of application that have the full acceptance of AHJ and that are tested in accordance with CAN/ULC-S115, and form a part of a ULC or cUL listed system, Engineered Judgement or Equivalent Fire Resistance Rated Assembly.

.2 Provide installation of fire stop systems in accordance with the recommended practices detailed in the following guides:

.1 FCIA Firestop Manual of Practice (MOP).

.3 Qualifications:

.1 Contractor specializing in selection and installation of fire stops approved by manufacturer.

.2 The installers are recognized as a Member in Good Standing with the Firestop Contractors International Association (FCIA). Submit proof of current membership upon request by DCC Representative or Third-Party Inspection firm.

.3 Certified Firestop Contractor: company certified with:

.1 ULC Qualified Firestop Contractor Program. Submit signed copy of certificate upon request by DCC Representative or Third-Party Inspection firm..

.4 Third-Party Inspection Firm: inspection agency with inspectors who have passed the ULC Firestop Exam

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings, manufacturing date and shelf life expiry date.

.2 Storage and Protection:

.1 Store materials in a well-ventilated, dry indoor location and in accordance with manufacturer's instructions.

.2 Coordinate delivery of materials with scheduled installation dates to allow minimum storage time on site.

.3 Comply with recommended procedures, precautions and measures described in WHMIS Safety Data Sheets (SDS).

.3 Waste Management and Disposal:

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

1.8 AMBIENT CONDITIONS

.1 Ambient Conditions:

.1 Install fire stops and smoke seals when ambient and substrate temperatures are within the limits prescribed by the manufacturer and when the substrate is dry and without risk of condensation.

.2 Maintain manufacturer's recommended ambient and substrate temperatures for 48 hours before and 72 hours after installation.

.2 Ventilate fire stops and smoke seals in accordance with manufacturers' instructions by natural means or, where this is inadequate or not available, use forced air circulation.

1.9 WARRANTY

.1 Extend 12 month warranty period to 24 months for Work of this Section.

.2 Manufacturers shall warrant work of this Section against defects and deficiencies in the product material for a period of 24 months. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense.

.3 Contractor warrants workmanship on materials and installation for a period of 24 months. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense.

Part 2 Products

2.1 MANUFACTURERS

.1 Provide products from a single manufacturer, to the greatest extent possible, to perform all fire stopping work. Materials of different manufacturers will not be permitted without authorization from DCC Representative.

.2 Provide a listed system from an alternative where there is no specific tested listed fire stop system available from the manufacturer for a particular fire stopping application to avoid providing an Engineering Judgment.

2.2 PERFORMANCE/DESIGN CRITERIA

.1 Fire stop and smoke seal systems consisting of a material or combination of materials installed to maintain the integrity of the fire-resistance rating of a fire separation in accordance with the requirements of the NBC.

.2 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the NBC, ULC Standards, and AHJ, and as follows:

.1 Non-rated fire separations: Provide L-Rated smoke protection fire stop system for application on both sides of separation.

.2 Provide through-penetration fire stop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of penetrated assembly, such as:

.1 Fire-resistance rated loadbearing walls, including partitions, with fire protection rated openings.

.2 Fire-resistance rated non-loadbearing walls, including partitions with fire protection rated openings.

.3 Fire-resistance rated floor assemblies.

.3 "F" Rated Systems: Provide through-penetration fire stop systems with F-ratings indicated, as determined by CAN/ULC-S115 or ASTM E 814, and equal to or exceeding the fire-resistance rating of the penetrations created during construction.

.4 "T" Rated Systems: Where fire stop systems protect penetrating items from potential contact with adjacent materials, provide through-penetration fire stop systems with T-ratings and F-ratings indicated, as determined by CAN/ULC-S115 or ASTM E 814, for the following conditions:

.1 Penetrations located outside wall cavities.

.3 Insulated Pipes: Design and test listed fire stop system with the actual insulation materials penetrating the fire separation, as indicated on the system design listing.

2.3 MATERIALS

.1 Compatibility: Under conditions of service and application, provide fire stopping and smoke seal systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating the systems, as demonstrated by fire stopping and smoke seal system manufacturer based on testing and site experience, and as follows:

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against the passage of flame, smoke and water and the transmission of heat in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended, as indicated on System Design Listing.

.2 Service penetration assemblies and fire stop components: Certified by testing laboratory to CAN/ULC-S115.

.3 Provide elastomeric seal or non-shrink foam cement mortar for fire and smoke stop systems at openings intended for re-entry, such as cables. Do not use cementitious or rigid seal at such locations.

.4 Provide elastomeric protection for fire and smoke stop systems at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control. Do not use a cementitious or rigid seal at such locations. Exemption for fire dampers.

2.4 FILL MATERIALS

.1 General:

.1 Provide fire stopping fill materials referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

.2 Fire stopping and smoke seal systems shall be tested in accordance with CAN/ULC-S115 and be comprised of asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases. Fire stopping and smoke seal systems not to exceed opening sizes for which they are intended for the ratings as indicated on Drawings.

.2 Latex Sealants: Single component latex formulations that after curing do not re-emulsify during exposure to moisture.

.3 Fire Stopping and Smoke Seal Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.

.4 Cable Penetration Devices:

.1 Pre-manufactured intumescent blocks

.2 Pre-manufactured sleeves, consisting of an adjustable core

.3 Pre-manufactured cable management system, consisting of a system of intumescent inserts and adjustable cores

.5 Intumescent Putties: Non-hardening dielectric, water resistant putties containing no solvents, inorganic fibres, or silicone compounds.

.6 Intumescent Spray Foam: Expanding spray-in-place intumescent foam sealant.

.7 Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.

.8 Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.

.9 Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

.10 Mortars: Pre-packaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

.11 Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass fibre cloth cases filled with a combination of mineral fibre, water insoluble expansion agents and fire-retardant additives.

.12 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in-place to produce a flexible, non-shrinking foam.

.13 Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:

.1 Grade for Horizontal Surfaces: Pourable (self-levelling) formulation for openings in floors and other horizontal surfaces.

.2 Grade for Vertical Surfaces: Non-sag formulation for openings in vertical and other surfaces.

.14 Ceramic-Fibre Sealant: Single-component formulation of ceramic fibres and inorganic binders.

2.5 MIXING

.1 For those products requiring mixing before application, comply with fire stopping and smoke seal system manufacturer's instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.6 FIRE STOP IDENTIFICATION

.1 Identification Labels and Markings: Permanent for the expected service life of the installation.

.2 Fire Stopped Penetrations:

.1 Provide identification labels at each penetration.

.2 Identification labels: embossed metal tags with metal fastening device with the following information:

.1 penetration number

.2 floor number

.3 room number

.4 product name and number

.5 system design number

.6 fire rating required in hours.

.7 fire stop contractor's name and phone number

.8 installer's name

.9 date of installation

.10 re-penetrated by: company, installer and date

.3 Indicate on label that fill material around the penetration is a fire stop system and shall not be disturbed except by authorized personnel.

2.7 ACCESSORIES

.1 Provide components for each fire stopping and smoke seal system needed to install fill materials. Use only components specified by fire stopping and smoke seal system manufacturer and approved by the qualified testing and inspecting agency for fire stopping and smoke seal systems indicated on Drawings.

.2 Primers: To manufacturer's recommendation for specific material, substrate, and end use.

.3 Water (if applicable): Potable, clean and free from harmful amounts of deleterious substances.

.4 Metal Fire Stop: Commercial galvanized steel, to ASTM A 1008/A 1008M, zinc coating 260 g/m ^{2}, minimum metal core thickness 0.912 mm.

.5 Steel Deck Moulded Flute Inserts: One-piece moulded mineral fibre flute inserts, sized for steel deck profiles, for placement at top of fire-rated wall assemblies

.6 Packing/Damming Materials, Supports and Anchoring Devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to AHJ.

.7 Junction Box/Outlet Sealing Putty: Intumescent putty, pre-formed in pads.

.8 Sealants: Good adhesion without use of primer, high visibility safety colours.

.1 Flame-spread rating: Maximum 25

.2 Smoke development classification: Maximum 50

.3 For vertical joints: Non-sagging

.4 For horizontal joints: Single component, self-levelling

Part 3 Execution

3.1 EXAMINATION

.1 Verify that conditions of substrates previously installed are acceptable for product installation in accordance with manufacturer's instructions and approved system design listings for each condition.

.2 Verify each opening/annular space to ensure it does not exceed the maximum and minimum dimensions indicated on the approved system design listing.

.3 Verify that all joints, service penetrating elements and supporting devices/hangers have been properly installed as indicated on approved system design listings. Remove all temporary lines and markings to meet the approved system design listings.

.4 Verify that proposed fire stop system consists of components that are compatible with each other, with substrates forming the openings, and with items, if any, penetrating the fire stop under conditions of application and service, as demonstrated by the fire stop manufacturer based on testing and site experience.

.5 Pipe Insulation: Confirm that proposed fire stop system has been tested with the actual insulation penetrating the fire separation on site, as indicated in the approved system design listing. Maintain insulation around pipes penetrating the fire separation.

.6 Ensure no additional items have been installed through opening that does not appear on the approved system design listing.

.7 Ensure fire stopped areas are accessible for proper application and that conditions are suitable for installation of the fire stop system. Areas to remain accessible for inspection.

.8 Report in writing to DCC Representative any defective surfaces or conditions affecting the fire stop system installation immediately and before commencing any installations.

.9 Proceed only once defected surfaces or conditions have been corrected.

.10 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Ensure substrates and surfaces are free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.2 Prepare surfaces in contact with fire stop and smoke stop materials to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

.5 Protect adjacent work areas and finish surfaces from damage during product installation.

.6 Prime surfaces as required.

.7 Ensure multi-penetration openings have been framed and boarded out around annular openings, as indicated in the system design listing before prepping the opening.

3.3 INSTALLATION

.1 Install fire stop materials and components in accordance with manufacturer's certified tested system listing.

.2 Coordinate with other sub-trades to ensure that all pipes, conduits, cables, and other items, which penetrate fire separations, have been permanently installed before installation of fire stop systems.

.3 Schedule work to ensure that fire separations and all other construction that conceals penetrations are not erected before installation of fire and smoke seal systems

.4 Seal holes or voids made by through-penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure that both continuity and integrity of fire separation are maintained.

.5 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing per manufacturer's instructions.

.6 Tool or trowel exposed surfaces to neat finish.

.7 Remove excess compound promptly as work progresses and upon completion.

.8 Do not use damaged or expired material.

3.4 INSTALLATION - THROUGH PENETRATION JOINT SEALANTS

.1 Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position required to achieve fire ratings of designated through-penetration fire stop systems.

.2 Install fill materials for through-penetration fire stop systems by techniques recommended by the manufacturer to produce the following results:

.1 Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

.2 Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

.3 For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

.3 Remove combustible forming materials and other accessories not indicated as permanent components of fire stop systems.

3.5 IDENTIFICATION

.1 General:

.1 Clean substrate before applying identification.

.2 Determine final location of identification on site.

.3 Identification is not required on both sides of the fire separation.

.2 Fire Stopped Penetrations:

.1 Install identification label adjacent to each fire stopped wall/floor service penetration. Provide one identification label per single opening or per grouping cluster.

.2 Securely apply identification to substrate by providing adequate adhesive

.3 Secure tags with metal fasteners or hang with metal chain or wire.

.4 Identification shall be completely filled out and installed before requesting substantial performance.

3.6 REPAIRS AND MODIFICATIONS

.1 Identify damaged or re-entered seals requiring repair or modification.

.2 Remove loose or damaged materials. If adding penetrating items, remove sufficient material to insert new elements and to avoid damaging the balance of the seal.

.3 Ensure sealed surfaces are clean and dry.

.4 Use only materials that are suitable for repair of original seal, as approved by manufacturer. Do not mix products from different manufacturers.

3.7 SITE QUALITY CONTROL

.1 Inspections: Notify DCC Representative when ready for inspection and before concealing or enclosing fire stop materials and service penetration assemblies.

.2 Manufacturer's Field Services:

.1 Obtain report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Site Reports as described in SUBMITTALS in Part 1 of this Section.

.2 Provide manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 INSPECTIONS

.1 Third-Party Inspection Firm: Provide the services of a third-party inspection firm to conduct random inspections and direct exploratory review (i.e., destructive testing) during the course of construction and before closing off any concealed areas. Perform inspections and destructive testing in compliance with ASTM E 2174

.2 DCC Representative to conduct random inspections and direct exploratory review (i.e., destructive testing) during the course of construction and before closing off any concealed areas. Perform inspections and destructive testing in compliance with ASTM E 2174 and ASTM E 2393.

.3 Perform exploratory review as directed by Third-Party Inspection Firm. Cut out fire stop and remove to ensure fire stop system installation meets or exceeds the system design listing as identified.

.4 Upon completion of construction and before requesting substantial performance review, fire stop contractor shall inspect all fire stopping work and prepare a deficiency list. Submit deficiency list to DCC Representative for review. Repair any deficiencies and re-inspect work to ensure that all deficiencies have been completed.

.5 Submit formal request for substantial performance review of work once all work is completed, quality control has been performed and all fire stop installations have been inspected and identified with the approved fire stop identification labels.

.6 DCC Representative will conduct the substantial performance review in the presence of the fire stop Contractor.

3.9 CLEANING

.1 Perform cleaning in accordance with Section 01 74 00 - Cleaning.

.2 Remove equipment, excess materials and debris and clean adjacent surfaces immediately after application. Use methods and cleaning materials approved by manufacturer.

.3 Protect fire stops during and after curing period from contact with contaminating substances

.4 Remove temporary dams after initial set of fire stop materials.

.5 Waste Management:

.1 Do not dispose of unused sealant materials into sewer system, streams, lakes, onto ground, or other location where it might pose a health or environmental hazard.

.2 Divert unused sealants from landfill to a hazardous material collection site.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Dispose of hazardous materials in accordance with the CEPA, TDGA, regional and municipal regulations.

3.10 SCHEDULE

.1 Design and provide through-penetration fire stopping as follows:

.1 Systems for metallic pipes, conduit, or tubing, select one or more of the following fill materials:

.1 latex sealant

.2 silicone sealant

.3 intumescent putty

.4 intumescent foam blocks or boards

.5 intumescent spray foam

.2 Systems for non-metallic pipe, conduit, or tubing, select one or more of the following fill materials:

.1 latex sealant

.2 silicone sealant

.3 intumescent putty

.4 intumescent foam blocks or boards

.5 intumescent spray foam

.3 Systems for miscellaneous electrical penetrations, select one or more of the following fill materials:

.1 latex sealant

.2 intumescent putty

.3 intumescent foam blocks or boards

.4 intumescent spray foam

.4 Systems for miscellaneous mechanical penetrations, select one or more of the following fill materials:

.1 latex sealant

.2 intumescent foam blocks or boards

.3 intumescent spray foam

.5 Systems for groupings of penetrations, select one or more of the following fill materials:

.1 latex sealant

.2 intumescent wrap strips

.3 fire stopping and smoke seal device

.4 intumescent composite sheet

.5 intumescent foam blocks or boards

.6 intumescent spray foam

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 84 00 - Fire Stopping

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):

- .1 ASTM C 834-17, Standard Specification for Latex Sealants
- .2 ASTM C 919-22, Standard Practice for Use of Sealants in Acoustical Applications
- .3 ASTM C 920-18, Standard Specification for Elastomeric Joint Sealants
- .4 ASTM C 1193-16, Standard Guide for Use of Joint Sealants
- .5 ASTM C 1330-18, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
- .6 ASTM C 1481-2012R17, Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS)
- .7 ASTM D 1056-20, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
- .8 ASTM D 2240-15(2021), Standard Test Methods for Rubber Property, Durometer Hardness
- .9 ASTM D 2628-91(2016), Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

.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 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:

- .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications

.7 Transport Canada (TC):

- .1 Transportation of Dangerous Goods Act, 1992 (2019 amended.) (TDGA)

.8 ULC Standards/ UL Canada (ULC):

.1 CAN/ULC 115-2018, Standard Method of Fire Tests of Firestop Systems

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 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:

.3 Submit one electronic copy of WHMIS SDS.

.3 Certificates: When requested by DCC Representative, submit manufacturer's product certificates indicating proposed sealant is appropriate for each application on this Project.

.4 Manufacturer's Instructions:

.1 Submit instructions for each type of product.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Submit maintenance data for incorporation into manual.

1.5 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.

.2 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.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Perform in accordance 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 off ground in a ventilated dry indoor location and in accordance with manufacturer's recommendations.

.2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.3 Do not dispose of unused sealant material into sewer system, streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.4 Divert unused joint sealing material from landfill to official hazardous material collections site approved by DCC Representative.

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 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 DCC Representative will arrange for ventilation system to be operated on maximum outdoor air and exhaust during installation of sealants. Ventilate area of work as directed by DCC Representative by use of approved portable supply and exhaust fans.

1.8 WARRANTY

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

.2 Warrant that sealant work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces in accordance with General Conditions, except for five years.

.3 Installer's Warranty: Provide an installation warranty, installer agrees to repair or replace joint sealants that do not comply with requirements of this Section for two years from Substantial Performance.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Each sealant system shall meet the following requirements for warranty period:

.1 Waterproof, flexible, and compatible with substrate under applicable service conditions.

.2 Provide a weather-tight seal that does not allow moisture penetration.

.3 Shall not de-bond, crack, or craze.

.4 Shall not leak.

2.2 SEALANT MATERIALS

.1 In air handling units and supply air system, use sealants without strong odours, without toxic chemicals, and are mould-resistant. When low toxicity sealants are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.2 Provide primers in accordance with manufacturer recommendation.

2.3 SEALANT MATERIAL DESIGNATIONS

.1 Type S-1: Acrylic Latex One Part, Shore A Hardness 20,

.2 Type S-2: Silicone Sealant; mould and mildew resistant.

.1 To ASTM C 920; type S; grade NS; class 50; use NT, G, and A.

.2 To ASTM C 920; type S; grade NS; class 25; use NT, G, and A.

.3 Type S-3: Silicone Sealant; general construction and air-seal sealant.

.1 To ASTM C 920: type S; grade NS; class 25; use NT, M, G, A, O.

.4 Type S-5: Acoustical Sealant; interior, non-skimming, non-hardening, simple component synthetic rubber sealant, to ASTM C 919.

.5 Type S-6: Multi-component polyurethane sealant; chemical curing, exterior wall sealant.

.1 To ASTM C 920: type M; grade NS; class 50; use T, NT, M, A, O.

.6 Type S-7: One-component polyurethane sealant; non-sag, for general construction.

.1 To ASTM C 920; type S; grade NS; class 25; use NT, M, A, O.

2.4 SEALANT SELECTION

.1 Where no specific type of sealant is scheduled, provide one of the sealants indicated in this Section appropriate for its application and consistent with manufacturer's recommendations and the recommendations of SWRI, Sealants: The Professionals' Guide.

.2 Make sealant selections consistent with manufacturer's recommendations.

.3 Use acrylic sealant Type S-1 only on the interior and only in situations where little or no movement can occur.

.4 Use mould & mildew resistant silicone sealant Type S-2 for nonmoving joints in kitchens. Do not use on floors.

.5 Use silicone general construction sealant Type S-3 or Type S-7 for all joints, interior and exterior, where no other specific sealant type specified.

.6 Use acoustical sealant Type S-5 and air seal sealant Type S-3 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.

.7 Use multi component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.

2.5 ACCESSORIES

.1 Preformed compressible and non-compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing:

- .1 Rod Type Sealant Backings:
  - .1 ASTM C 1330, Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi cellular material with a surface skin).
  - .2 Provide any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.
  - .3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
  - .4 Non adhering to sealant, to maintain two sided adhesion across joint.
- .2 High Density Foam:
  - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m ^{3} density, or neoprene foam backer, size as recommended by manufacturer.
- .3 Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, non absorbent to water and gas, capable of remaining resilient at temperatures down to 15 deg C. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.
- .4 Bond Breaker Tape:
  - .1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.

.2 Preformed Sealants:

- .1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to substrates.
- .2 Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open cell compression type complying with ASTM D 2628 and with requirements for size, profile and cross sectional design.

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

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

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

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

2.6 COLOURS

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

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for joint sealants installation in accordance with manufacturer's instructions.

.1 Visually inspect substrate.

.2 Verify joint surfaces are dry and frost free.

.3 Verify substrates are without contaminants capable of interfering with sealant adhesion. Remove contaminants where occurring.

.4 Examine joint sizes and conditions to establish acceptable depth to width ratio for installation of backup materials and application of sealants.

.5 Verify joint widths are within the limits recommended by joint sealant manufacturer for applications indicated.

.6 Inform DCC Representative of unacceptable conditions immediately upon discovery.

.7 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SURFACE PREPARATION

.1 Clean bonding joint surfaces of harmful contaminates including dust, rust, oil grease, and other matter which may impair adhesion.

.2 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.

.3 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Mask adjacent surfaces prior to priming and sealing where necessary to prevent staining.

.2 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.

.3 Prime all porous material (e.g. wood, masonry, concrete, ceramic or paver tile, etc).

3.4 BACKUP MATERIAL

.1 Provide backer rod as specified, to limit depth of sealant and to act as bond breaker at back of joint.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

.3 Apply paper masking tape to back of joint to act as bond break where depth of joint does not permit the use of backer rod.

.4 Ensure that no joints are formed which are bonded on adjacent sides where there is any possibility of movement.

3.5 MIXING

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

3.6 APPLICATION

.1 Sealant: Application: Apply sealants to recommendations of ASTM C 1193, and in accordance with manufacturer's instructions, and as follows:

.1 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 For joints where movement is possible, apply backer rod to achieve a joint depth of one half the joint width but not less than 9 mm; for joints larger than 25 mm use a depth of 13 mm

.4 Apply sealant in a continuous beads.

.5 Apply sealant using gun with proper size nozzle.

.6 Fill voids and joints solid.

.7 Form sealant surface with a smooth full bead, without from ridges, wrinkles, sags, air pockets, embedded impurities.

.8 Tool exposed surfaces before skinning begins to give slightly concave shape.

.9 Ensure bead is solid, filling entire space between sides and bedding material, exerting sufficient pressure to obtain maximum bond, by allowing sealant to bulge out in advance of nozzle.

.10 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.

.11 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.

3.7 CLEANING

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

.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.

.2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning upon completion.

.3 Waste Management:

.1 Do not dispose of unused sealant materials into sewer system, streams, lakes, onto ground, or other location where it might pose a health or environmental hazard.

.2 Divert unused sealants from landfill to a hazardous material collection site.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Dispose of hazardous materials in accordance with the CEPA, TDGA, regional and municipal regulations.

3.8 PROTECTION

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

.2 Repair damage to adjacent materials caused by joint sealants installation.

3.9 SCHEDULE

.1 Use acrylic sealant Type S-1 only on the interior and only where little or no movement can occur.

.2 Use mould and mildew-resistant silicone sealant Type S-2 for non-moving joints in kitchens. Do not use on floors.

.3 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type is specified.

.4 Use acoustical sealant Type S-5 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.

.5 In addition, provide joint sealants at the following conditions:

.1 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 61 00 – Product Requirements

.3 Section 01 74 00 – Cleaning

1.2 REFERENCE STANDARDS

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

.1 Safety Data Sheets (SDS).

.2 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual (2020)

.2 Maintenance Repainting Manual (2020).

.3 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 paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit for review and acceptance of each unit.

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - 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 Provide and maintain dry, temperature controlled, 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 dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada (NFC) requirements.

.5 Waste management related to Work of this Section to be included in Waste Management and Disposal (WMD) Plan specified in Section 01 35 43 – Environmental Procedures.

1.5 SITE CONDITIONS

.1 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.

.2 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

.2 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.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of DCC Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 Supply paint materials for paint systems from single manufacturer.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

.3 Colours:

.1 Submit proposed Colour Schedule to DCC Representative for review.

.4 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.

.5 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	

.6 Interior painting:

.1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.

.1 INT 5.1E Alkyd G4 finish

.2 Galvanized Metal:

.1 INT 5.3C - Alkyd G3 finish

.3 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock" type material, etc.

.1 INT 9.2A - Latex G3 finish

.2 INT 9.2C - Alkyd G3 finish

.7 Interior re-painting:

.1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.

.1 RIN 5.1E - Alkyd G4 finish

.2 Galvanized Metal:

.1 RIN 5.3C - Alkyd G3 finish

.3 Plaster and Gypsum Board: gypsum wallboard, drywall, "sheet rock" type material, etc.

.1 RIN 9.2A - Latex G3 finish

.2 RIN 9.2C - Alkyd G3 finish

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 - Maintenance Repainting Manual and MPI - Architectural Painting Specifications 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.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 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 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of DCC Representative.

.4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.

.8 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 Use method of application approved by DCC Representative.

.1 Conform to manufacturer's application recommendations.

.3 Apply coats of paint in continuous film of uniform thickness.

.1 Repaint thin spots or bare areas before next coat of paint is applied.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

3.5 CLEANING

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

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

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

.3 Place primer, paint, stains defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 23 00 Refrigerant Piping.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B16.26-2018, Cast Copper Alloy Fittings for Flared Copper Tubes.

.2 ANSI/ASME B16.29-2017, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings-DWV.

.2 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 255-2006, Standard Method of Test of Surface Burning Characteristics of Building Materials.

.3 ASTM International (ASTM)

.1 ASTM B 88M-20, Standard Specification for Seamless Copper Water Tube.

.2 ASTM B 280-20, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 ASTM E 84-22, Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E 162-21, Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

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

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Construction details of equipment by drawings and manufacturers' literature.

.2 Roughing-in requirements for mechanical and electrical services.

.3 Installation details.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 REFRIGERATION EQUIPMENT (FOR REMOTE INSTALLATION)

.1 Refrigeration equipment: with refrigerant, fully automatic in operation, and to conform to following minimum requirements:

.1 Condensing units: complete with motor, water cooled condenser as per schedule, safety screen, receiver, hermetic or accessible hermetic type compressor, and other necessary components mounted in flexible manner on common base.

.1 Design unit for 16 hours to 18 hours operation at specified evaporating temperature, in 32.2 degrees C ambient temperature.

.2 Evaporator: forced-convection, unit-cooler type, suspended from ceiling panels, with forced-air discharged parallel to ceiling.

.1 Assemble air circulating motor, multifin and tube type coil and grille within protective housing also, contain expansion valve, with strainer, heat exchanger and inlet and outlet connections within same housing complete with safety screen.

.2 Air circulation motors: lifetime sealed.

.3 Entire unit-cooler assembly readily accessible for cleaning. Provide drip pan and drain connection.

.4 Equip unit coolers with mounting brackets for installation and controls for safe and satisfactory operation.

.5 When walk-in is used for freezer applications, provide an automatic system for defrosting unit cooler, including heaters and time control.

.2 Refrigerant tubing:

.1 Conform to ASTM B 88M and ASTM B 280 requirements.

.2 Relief valve discharge pipe on outdoor installations shall be copper tube type "L" with brazed joints.

.3 Fittings:

.1 Conform to ANSI/ASME B16.26 and ANSI/ASME B16.29.

.2 Long radius type for elbows and return bends.

2.2 PRE-ASSEMBLED REMOTE REFRIGERATION SYSTEMS

.1 Provide pre-assembled remote refrigeration equipment complete with electrical and refrigeration connections including necessary components factory-installed on both evaporator and condensing unit assemblies, prewired, ready for site connections.

.2 Evaporator assembly in addition to evaporator, to include heat exchanger, temperature control and expansion valve.

.3 Condensing unit assembly, in addition to condensing unit, to include sight glass, drier, time clock and vibration eliminator and suction accumulator.

2.3 DRAIN LINES AND HEATER CABLES

.1 Provide necessary drain lines to funnel drains and heater cables as required.

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 walk-in freezers and cooler refrigeration system 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 Supply appropriate protection apparatus.

.2 Install in accordance with manufacturer's written recommendations.

.3 Install equipment true-to-line, plumb, and square.

.4 Cut or drill holes in panels, as required, to accommodate electrical and mechanical services, runs or connections.

.1 Insert teflon sleeves into holes and seal.

.2 After installation of services, fill remaining space with insulation.

.5 Cap wrench access holes with an in-fitting, flush, stainless steel removable plug.

.6 Install removable closure panels, cover strips, and angles.

.7 Wire from existing disconnect switches inside coolers and freezers.

3.3 ADJUSTING

.1 Remove protective coverings and test and adjust operating equipment.

3.4 CLEANING

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

.1 Clean equipment and apparatus.

.2 Re-finish damaged coatings and finishes.

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

.3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by walk-in freezer and cooler refrigeration system replacement.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.18-21, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ANSI/ASME B16.22-18, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.26-18, Cast Copper Alloy Fittings for Flared Copper Tubes.

.2 ASTM International (ASTM)

.1 ASTM A536-84 (2019), Standard Specification for Ductile Iron Castings.

.2 ASTM B32-08 (2014), Standard Specification for Solder Metal.

.3 ASTM B42-20 (2020), Seamless Copper Tube, Standard Sizes.

.4 ASTM B88M-20 (2020), Standard Specification for Seamless Copper Water Tube (Metric).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-14, Fire Endurance Tests of Buildings Construction and Materials.

.2 CAN/ULC S102.2-18, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.3 CAN/ULC S115-18, Standard Method of Fire Tests of Firestop.

.4 Department of Justice Canada (Jus)

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

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

.1 Safety Data Sheets (SDS).

.6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-17, Butterfly Valves.

.2 MSS-SP-70-11, Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-18, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80-19, Bronze Gate, Globe, Angle and Check Valves.

.7 National Research Council (NRC)

.1 National Plumbing Code of Canada (NPC) 2020.

.8 Transport Canada (TC)

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

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 piping, fittings, joints and valves, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground:

.1 Copper tube, hard drawn, type L to ASTM B88M.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 1 ½ and smaller:

.1 cast copper to ANSI/ASME B16.18 with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 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: tin copper alloy 95/5.

.4 Teflon tape: for threaded joints.

.5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves – Bronze.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

2.7 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with 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 Valves

.1 Isolate equipment, fixtures and branches with ball or gate valves.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 15.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. 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 to Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

.2 Upon completion, provide laboratory test reports on water quality for DCC Representative approval.

3.7 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Commission water conditioning specified Section 22 31 16 – Commercial Domestic Water Softeners.

.4 Bring HWS storage tank up to design temperature slowly.

.5 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.6 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet equipment design requirements.

.2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Sterilize new HWS and HWC systems for Legionella control.

.4 Verify performance of temperature controls.

.5 Verify compliance with safety and health requirements.

.6 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.

.7 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 In accordance with Section 01 91 00 - Commissioning: Reports, using report forms as specified in Section 01 91 00 - Commissioning: Report Forms and Schematics.

.4 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure

3.9 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

3.10 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA B51-19, Boiler, Pressure Vessel, and Pressure Piping Code.

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

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

1.5 EXTRA MATERIALS

.1 Provide spare parts in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide one spare regenerating valve.

.3 Deliver to DCC Representative upon completion of Work of this Section.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Commercial cation exchanger (sodium zeolite) water softening equipment: factory assembled and disassembled, as necessary for shipment with connecting components clearly identified.

.2 System includes softener tank, brine tank, brine forming system, brine distribution system, regenerating manifolding and controller systems.

.3 System capacity: 1300/1950 kg min/max.

.4 System delivery: 0.55 L/min maximum.

.5 Inlet water temperature range:

.1 Standard softener: 1°C - 38°C.

.2 Hot water softener: 1°C - 65°C.

.6 Pressure drop: 105 kPa maximum.

.7 Ensure Zeolite used is sulfonated high capacity styrene base synthetic resin.

.1 Provide each unit with 0.028 m^3 of resin.

.2 Resin exchange capacity: 0.914 eq/L minimum / 1.372 eq/L maximum when regenerated with 2.7 kg/ 6.8 kg sodium chloride salt respectively.

.8 Minimum requirements:

.1 Ensure backwash drains to open funnel drain as indicated.

.2 Gravel bed: washed and graded silica gravel sized to retain zeolite and to provide complete distribution of water when backwashing.

.3 Piping: as indicated.

.1 Include piping and regenerating valves within softener and brine tanks.

.2 Sampling cock: on soft water line from softener.

.3 Pressure gauges for each softener tank: two, 89 mm dia compound pressure and vacuum gauges giving entering and leaving readings.

2.2 PERFORMANCE DESIGN CRITERIA

.1 System to provide softened water of quality specified, based on raw water supply analysis obtained by Contractor.

.2 For reference only, preliminary water analysis results from June 2021 sample as follows:

PARAMETER	APPROX. VALUE
Hardness	120 ppm
Alkalinity	240 ppm
Chlorine	0 ppm
pH	7.5
Total dissolved solids	500 ppm

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 Provide certificate, signed by manufacturer, stating that pipe system has been installed in accordance with manufacturer's recommendations.

.2 System to be completely accessible for removal, modification and cleaning.

3.3 CLEANING

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

Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 84 00 - Fire Stopping

.2 Section 09 91 00.08 – Painting for Minor Works

.3 All sections in Division 23

1.2 SUBMITTALS

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

.2 Submit all information and data in both printed paper format and PDF electronic format. The PDF electronic format will be used for insertion into the Building Interactive Electronic Operating and Maintenance and Commissioning Manuals. Scanned PDF's are not acceptable. All PDF submittals must be text searchable**.**

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.
- .3 Refer to individual specification sections for detailed requirements.

.4 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.

.5 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with DCC Representative before final inspection.
- .3 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.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment and the integrated complete system.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 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.

.6 Site records and As-Built Drawings:

.1 Mark changes on site drawings as work progresses and as changes occur, in accordance with Section 01 78 00 – Closeout Submittals.

1.3 QUALITY ASSURANCE

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.4 Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Section 01 74 00 - Cleaning.

Part 2 Products

2.1 DUCT AND PIPE MOUNTED CONTROL AND SENSING EQUIPMENT

.1 The following automatic control equipment will be supplied by Division 25 but installed by the appropriate trade sections of Division 23:

.1 Automatic control valves.

.2 Temperature control wells.

.3 Pressure tappings.

.4 Flow switches.

2.2 ACCESS DOORS

.1 Supply flush mounted access doors, for installation by Building Trades in furred ceilings and walls, to permit servicing of mechanical equipment and accessories, inspection of life safety or operating devices, and where specifically indicated.

.2 Unless otherwise noted, access doors shall be minimum: 450 mm x 450 mm for body entry; 300mm x 300mm for hand entry; 200 mm x 200 mm for cleanout access. Access doors in building surfaces shall be at least as large as duct access panels accessed through them and shall be oversized when necessary. Size to suit masonry modules when located in a masonry wall.

.3 Locate access doors so that all concealed items are readily accessible for adjustment, operation and maintenance. Locate in service and storage areas wherever possible. Do not locate in panelled, feature or special finish walls, without prior approval of the DCC Representative.

.1 Access doors in fire separations of 3/4 hour rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self closing.

.4 Minimum Requirements:

.1 180 degree door swing, mitred rounded safety corners flush welded, concealed hinges, screwdriver latches, and anchor straps or lugs to suit construction, all steel prime coated.

.2 Plaster or wet wall construction: 14 gauge bonderized steel flush with wall or ceiling type with concealed flange.

.3 Masonry or drywall construction: 16 gauge for 400 mm x 400 mm and smaller, 14 gauge for 450 mm x 450 mm and larger bonderized steel face of wall type with exposed flange.

.4 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: 14 gauge stainless steel flush with wall or ceiling type with concealed flange.

.5 Acoustical tile ceiling and similar block materials: 14 gauge bonderized steel recessed ceiling type.

.6 Access panels in fire separations and fire walls shall have a compatible fire rating and ULC label.

2.3 TESTING AND SERVICING EQUIPMENT

.1 Manufacturers of mechanical equipment shall supply any testing units, calibrating units or software that service technician will require for routine inspection, maintenance and repair activities.

Part 3 Execution

3.1 CUTTING AND PATCHING

.1 Include all cutting and patching required to accommodate mechanical services.

.2 Openings through structural members of the building shall not be made without the approval of DCC Representative.

.3 Size and locate all openings required under Division 23, including pipe sleeves. Allow oversized openings for pipe penetrations where insulation is specified.

.4 Contractor shall be on site and coordinate sleeves and block out requirements in accordance with the project construction schedule.

3.2 EQUIPMENT SUPPORTS

.1 Provide stands and supports for equipment and materials supplied.

.2 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25 mm above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout.

.3 Construct equipment supports of structural steel or steel pipe. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.

.4 Support ceiling hung equipment with rod hangers and/or structural steel.

3.3 EQUIPMENT RESTRAINT

.1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

3.4 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping and duct systems and without interfering with building structure or other equipment.

.2 Provide means of access for servicing equipment including permanently lubricated bearings.

.3 Pipe equipment drains to floor drains.

.4 Line up equipment, rectangular cleanouts and similar items with building walls wherever possible.

3.5 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

3.6 MISCELLANEOUS METALS

.1 Be responsible for all miscellaneous steel work relative to Division 23 of the Specifications, including but not limited to:

.1 Support of equipment

.2 Hanging, support, anchoring, guiding and relative work as it applies to piping, ductwork, heat exchangers, hot water storage tanks, expansion tanks, fans and mechanical equipment.

.3 Pipe anchor and/or support posts.

.4 Ceiling ring bolts - secure to structure or steel supports.

.2 All steel work shall be prime and undercoat painted ready for finish under Division 9. Refer to drawings for details.

3.7 FLASHING

.1 Flash and counterflash where mechanical equipment passes through weather or water proofed walls, floors, and roofs.

3.8 DIELECTRIC COUPLINGS

.1 Provide dielectric couplings wherever pipes of dissimilar metals are joined.

.2 Provide insulating unions for pipe sizes NPS 2 and under and flanges for pipe sizes over NPS 2.

.3 Provide felt or rubber gaskets to prevent dissimilar metals contact.

3.9 LUBRICATION OF EQUIPMENT

.1 Lubricate all new equipment prior to being operated, except sealed bearings, which shall be checked.

.2 Use the lubricant recommended by the manufacturer for the service for which the equipment is specified.

.3 Extend lubricating connections and sight glasses to the outside of housings, where lubricating positions are not readily accessible.

3.10 PAINTING

.1 Painting of all equipment and materials, supplied under Division 22 and 23, installed in mechanical equipment areas and inside finished areas of the building or exposed outside the building, is included in Sections 09 91 23 – Interior Painting.

.2 Clean exposed bare metal surfaces supplied under Divisions 22, 23 removing all dirt, dust, grease and millscale. Apply minimum of two coats of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.3 Repaint all marred factory finished equipment supplied under Division 22, 23, which is not scheduled to be repainted, with minimum two coats to match the original factory finish.

3.11 EQUIPMENT PROTECTION AND CLEAN UP

.1 Protect equipment and material in storage, on site and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 All mechanical equipment stored on site shall be kept in a dry, heated and ventilated storage area.

.3 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.

.4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.5 Provide, install and maintain 30% efficient (MERV 8) temporary filters to return and exhaust air openings from ceiling spaces to prevent air born dust from entering ducts, plenums and coils. Install filters to return air grilles when fans are operated and building is not at a clean condition.

3.12 CLEANING

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

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

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

3.13 DECONSTRUCTION

.1 Includes all labor, materials, equipment and services necessary and incidental to complete all the deconstruction and removal of all related mechanical installations as identified on the Drawings.

.2 The Contractor shall be responsible for deconstruction and removal of all existing mechanical equipment and systems where shown for deconstruction.

.3 Contractor shall verify the extent of the deconstruction work. Any questions as to which systems are to be removed versus which systems are to remain shall be referred to DCC Representative for clarification prior to commencing deconstruction work.

.4 The deconstruction work shall be a phased operation and shall comply with the construction sequence schedule. The Contractor shall submit a schedule of deconstruction work 14 days prior to commencement of work. The Contractor shall not proceed with the work until receiving written approval from DCC Representative.

.5 The Contractor shall be responsible for coordinating deconstruction of all affected mechanical equipment and systems to prevent disruption to the facility and minimize downtime.

.6 The Contractor shall be responsible for coordinating deconstruction by other Divisions of the Specifications to prevent disruption to the facility and to minimize downtime.

.7 The Contractor shall include all temporary connections necessary to permit the Owner or users to occupy areas of the building during the various construction phases.

.8 Contractor shall remove existing equipment and systems, shown or specified, necessary or reasonably inferred, for completion of work. All deconstruction waste and materials removed will become the property of the Contractor, removed from the premises and legally disposed off-site.

.9 Existing work altered during the course of construction shall be placed in safe operating condition and shall be maintained and remain in service, unless otherwise noted, and shall be restored to satisfactory operating condition.

.10 Where existing piping is removed, cap piping and pressure test to make tight.

.11 After completing deconstruction work inspect all exposed finishes and repair damaged finishes. Reinstall fire stopping at rated penetrations, where applicable.

3.14 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.15 DEMONSTRATION

.1 DCC Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 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.

.3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 DCC Representative may record these demonstrations for future reference.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Use of HVAC systems during construction.

1.2 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC

1.3 USE OF SYSTEMS

.1 Do not operate HVAC systems during construction, except for the specified purpose of testing, commissioning and demonstration.

.2 Use of new heating and ventilating systems for supplying temporary heat or ventilation is permitted only with prior permission of DCC Representative and under the following conditions:

.1 Entire system is complete, pressure tested, cleaned, flushed out.

.2 Specified water treatment system has been commissioned; water treatment is being continuously monitored.

.3 Building has been closed in. Areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.4 There is no possibility of damage.

.5 Supply ventilation systems are protected by 60% filters, inspected daily, and changed every 2 weeks or more frequently as required.

.6 Return systems have approved filters over openings, inlets, outlets.

.7 Systems will be:

.1 Operated as per manufacturer's recommendations and instructions.

.2 Operated by Contractor.

.3 Monitored continuously by Contractor.

.8 Warranties and guarantees are not relaxed.

.9 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of DCC Representative.

.10 Refurbish entire system before static completion; clean internally and externally, restore to "as-new" condition, replace filters in air systems.

.3 Filters specified in this Section are over and above those specified in other Sections of this project.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and requirements for installation of mechanical piping.

1.2 RELATED SECTIONS

.1 Section 07 84 00 - Fire Stopping

.2 Section 23 05 00 - Common Work Results for HVAC

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.4 Section 23 08 02 - Cleaning and Start-Up

1.3 REFERENCES

.1 National Building Code of Canada, 2020.

.2 National Plumbing Code of Canada, 2020.

.3 National Fire Code of Canada, 2020.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.5 American Society for Testing and Materials International, (ASTM).

.1 ASTM E814 - 13a, Standard Test Method for Fire Tests of Penetration Firestop Systems

.6 Underwriters Laboratories Canada

.1 ULC CAN-S115, Standard Method of Fire Tests of Firestop Systems

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

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 for all equipment.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment and 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. 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 manual air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Comply with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.2 Screwed fittings jointed with Teflon tape, unless stated otherwise.

.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 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space. In mechanical and other service areas, piping will generally be surface mounted. Surface mounted piping will not be permitted within Kitchen area.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible and as indicated.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion where required and as indicated.

.14 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless otherwise indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.

3.8 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 All piping, tubing, ducts, wiring, conduits, etc., passing through rated fire separations shall be smoke and fire proofed with ULC approved materials.

.2 Fire stopping is included in Section 07 84 00 – Fire Stopping.

3.9 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 All piping, tubing, ducts, wiring, conduits, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent the passage of smoke and/or transmission of sound. Refer to "pipe sleeve" clause in this section for packing and sealing of pipe sleeves.

3.10 PIPE SLEEVES

.1 Provide pipe sleeves for all piping passing through rated walls and floors. Sleeves to be concentric with pipe.

.2 Pipes and ducts passing through fire rated separations that have no fire resistance (non-rated separations) do not require a sleeve, but the insulation at the separation should be wrapped with 0.61mm thick galvanized sheet steel band to which to apply the flexible caulking compound to.

.3 Pipe sleeves interior walls shall be minimum 0.61mm thick galvanized sheet steel with lock seam joints.

.4 Pipe sleeves for perimeter walls shall be cast iron sleeve or Schedule 40 steel pipe with annular fin continuously welded at midpoint and protruding 150 mm beyond sleeve diameter. Annular fin shall be embedded into centre of wall.

.5 Except as otherwise noted pipe sleeves are not required for holes formed in interior concrete walls.

.6 Pipe sleeves shall extend 25 mm on each side of walls in unfinished areas and 6 mm in finished areas.

.7 Pipe sleeves shall extend 25 mm beyond exterior face of building. Caulk with flexible caulking compound.

.8 Sleeve Size: 12 mm clearance all around, between sleeve and pipe or between sleeve and pipe insulation.

.9 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.

.10 Packing of Sleeves:

.1 Where sleeves pass through perimeter walls the space between sleeve and pipe or between sleeve and pipe insulation shall be caulked with waterproof fire retardant non-hardening mastic.

3.11 ESCUTCHEONS AND SLEEVES

.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

.2 Plates shall be stamped steel, split type, chrome plated, or stainless steel, concealed hinge, complete with springs, suitable for external dimensions of piping/insulation. Secure to pipe or finished surface for all pipes passing through suspended ceilings and uninsulated piping passing through walls. Outside diameter shall cover opening or sleeve.

.3 Where pipe sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

.4 Do not install escutcheons and plates in concealed locations.

3.12 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation by Section 07 84 00 - Fire Stopping.

3.13 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-Up.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 – Cleaning, 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.

3.14 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise DCC Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 23.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Division 23.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of 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.

3.15 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.

3.16 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Divisions 22, 23 and 25. Refer to Division 26 for quality of materials and workmanship.

1.2 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC.

1.3 REFERENCES

.1 National Building Code of Canada, 2020.

.2 Canadian Electrical Code, 2020.

.3 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.4 Electrical Equipment Manufacturers' Association Council (EEMAC)

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

.1 Safety Data Sheets (SDS).

1.4 SUBMITTALS

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

.2 Shop Drawings:

.1 Submit shop drawings for review. Include the following:

.1 Manufacturer's printed product literature, specifications and datasheets.

.2 Motor characteristics, performance criteria, and limitations.

.3 Installation requirements.

.4 Efficiencies.

.5 Compatibility with variable speed drive, where scheduled.

.6 Motor shop drawings will usually be submitted with the equipment which the motor serves.

.3 Quality Control Check Sheets

.4 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with the NBC and CEC requirements.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 70 03 - Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 GENERAL

.1 Motors: premium efficiency, in accordance with ASHRAE 90.1.

2.2 MOTORS - GENERAL

.1 Provide motors for mechanical equipment as specified.

.2 Unless noted otherwise, provide open drip-proof, ball or roller bearing motors with grease fittings.

.3 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.4 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 575 V, unless otherwise indicated.

.5 All motors shall be designed and manufactured to operate with ±10% voltage and ±5% frequency variations of the nameplate ratings. Combined voltage and frequency variation shall not exceed ±10%.

.6 Motors will be rated for a 1.15 service factor in a 40°C ambient environment.

.7 All motors to be standard 1800 RPM unless specifically scheduled otherwise.

.8 Provide all motors with terminal boxes, suitable for power connections.

.9 Provide screw adjustable bases on all belt-connected motors.

.10 Motors to be of the capacitor start type when they may be manually cycled from a starting switch, which is located in the finished space.

.11 Motors exposed to outdoor temperature to be lubricated with lubricants suitable for operation at 6 deg. C. below the lowest temperature recorded by ASHRAE or the Climatic Information (Supplement to the National Building Code), for the location in which they are installed.

2.3 ELECTRIC MOTORS – PREMIUM EFFICIENCY

.1 All motors shall be provided with premium efficiency classification with non-wicking leads, class 'B' for O.D.P. motors (pumps only) and class 'F' for TEFC motors insulation (minimum).

.1 Premium efficiency open drip-proof motors shall have the following typical full load efficiencies (nominal):

HP	Premium Efficient - Minimum Efficiency (%)		
	3600 RPM 2 Pole	1800 RPM 4 Pole	1200 RPM 6 Pole
1	80.0	85.5	82.5
1.5	84.0	86.5	86.5
2	85.5	86.5	87.5
3	86.5	89.5	88.5
5	91.0	89.5	90.2
7.5	88.5	91.0	92.4
10	90.2	91.7	91.7
15	91.0	93.0	92.4

.2 Premium efficiency totally enclosed fan cooled motors shall have the following typical full load efficiencies (nominal).

HP	Premium Efficiency - Minimum Efficiency (%)		
	3600 RPM 2 Pole	1800 RPM 4 Pole	1200 RPM 6 Pole
1	N/A	86.5	81.5
1.5	85.5	85.5	86.5
2	85.5	85.5	87.5
3	87.5	88.5	88.5
5	89.5	89.5	89.5
7.5	91.0	91.7	91.7
10	91.7	91.7	91.7
15	91.7	92.4	91.7

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm thick sheet metal tops and bottoms.

.3 38 mm dia holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

Part 3 Execution

3.1 ELECTRIC MOTORS

.1 Unless otherwise noted, starters and protection devices will be included under the Electrical Division of the Specification.

.2 Assist Division 26 to ensure proper connection, correct thermal overload protection and correct motor controls.

.3 Where starters are included in this Division as an integral part of packaged equipment, they shall contain thermal overload protection in all ungrounded lines.

.4 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch.

.5 If delivery of specified motor will delay delivery or installation of any equipment, install an acceptable motor for temporary use. Final acceptance of equipment will not be given until specified motor is installed.

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

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 SETTING AND ALIGNMENT

.1 Employ a journeyman millwright to align all V-belt drives and/or shaft coupling drives prior to initial start up. The millwright shall also check that centrifugal fan wheels are properly centred on fan shafts.

.2 For pumps, align shaft couplings, using a dial indicator, to within +/-0.051 mm after grouting is complete and the piping system is operational.

.3 Align V-belt drives using a straight edge.

.4 Submit a certificate from the millwright employed, certifying that all shaft couplings and V-belt drives have been aligned and centrifugal fan wheels centred prior to initial start up and checked again after final system balance adjustment.

3.4 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 Green Seal Environmental Standards (GSES)

.1 Standard GS-11-2021, Edition 4.0, Environmental Standard for Paints and Coatings.

.3 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2020 (NFC).

.4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2013, Architectural Coatings.

.2 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.

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, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

.1 Sustainability Standards Certification:

.1 Low-Emitting Materials: provide listing of sealants and coatings to be used in building, comply with VOC and chemical component limits or restriction requirements.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

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

Part 2 Products

2.1 MATERIAL

.1 Paint: zinc-rich to CAN/CGSB-1.181.

.1 Primer: maximum VOC limit 250 g/L to Standard GS-11.

.2 Paints: maximum VOC limit 150 g/L to Standard GS-11.

.2 Sealants: maximum VOC limit to GSES GS-36.

.3 Adhesives: maximum VOC limit to GSES GS-36

.4 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping

Part 3 Execution

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer s instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.1 Discharge to be visible.

.4 Drain valves: 15 mm gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

.1 Install air vents to at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 50mm and under: isolating unions or bronze valves.

.4 Over 50 mm: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Install pipework to National Building Code of Canada.

.2 Screwed fittings jointed with Teflon tape.

.3 Protect openings against entry of foreign material.

.4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.10 Install, except where indicated, to permit separate thermal insulation of each pipe.

.11 Group piping wherever possible and as indicated.

.12 Ream pipes, remove scale and other foreign material before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Provide for thermal expansion as indicated.

.15 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use gate valves at branch take-offs for isolating purposes except where specified.

.7 Use chain operators on valves 65 mm and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.16 Check Valves:

.1 Install silent check valves in vertical pipes with downward flow, on discharge of pumps and as indicated.

.2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere:

.1 Provide space for fire stopping.

.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 FIRE STOPPING

.1 Coordinate the installation of fire stopping around pipes, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.

.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 02 - Cleaning and Start-up.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning 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 DCC Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of DCC Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. DCC Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by DCC Representative.

3.13 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by DCC Representative.

.2 Request written approval by DCC Representative 7 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

3.14 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse or recycling.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-18, Standard Specification for Carbon Steel Forgings, for Piping Applications.

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

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.

.1 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

Part 2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, as indicated.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with ends for welding.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B.

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 minimum, PTFE impregnated non-asbestos.

.9 Thermal plastic packing: PTFE impregnated non-asbestos slug supplied loose.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer s recommendations.

.13 Lubricant gun: complete with hose assembly.

.14 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug.

2.2 GROOVED END EXPANSION JOINTS

.1 Packless, Gasketted, Slip, Expansion Joints:

.1 2413 kPa maximum working pressure.

.2 Steel pipe fitting consisting of telescoping body and slip-pipe sections.

.3 PTFE modified polyphenylene sulfide coated slide section.

.4 Suitable for axial end movement to 75 mm.

.2 Expansion joint consisting of series of grooved end pipe nipples joined in tandem with flexible couplings. Total joint movement dependent on number of couplings and nipples used.

2.3 FLEXIBLE CONNECTION

.1 Application: to suit motion as indicated.

.2 Minimum length in accordance with manufacturer s recommendations to suit offset

.3 Inner hose: stainless steel corrugated.

.4 Braided wire mesh stainless steel outer jacket.

.5 Diameter and type of end connection: as indicated.

.6 Operating conditions:

.1 Working pressure: 1034 kPa.

.2 Working temperature: maximum 100ºC

.3 To match system requirements.

.7 Three flexible grooved couplings placed in close proximity to vibration source for vibration attenuation and stress relief.

2.4 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated.

.2 Alignment guides:

.1 Provide as indicated.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install expansion joints with cold setting, Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer s instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

.4 Do welding in accordance with Section 23 05 17 - Pipe Welding.

3.3 PIPE CLEANING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up

3.4 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification – Mechanical Piping Systems.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1-2018, Power Piping.

.2 ANSI/ASME B31.3-2016, Process Piping.

.3 ANSI/ASME Boiler and Pressure Vessel Code-2017:

.1 BPVC 2017 Section I: Power Boilers.

.2 BPVC 2017 Section V: Nondestructive Examination.

.3 BPVC 2017 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206-17, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1M/C1.1-2019, Recommended Practices for Resistance Welding.

.2 AWS Z49.1-2021, Safety in Welding, Cutting and Allied Process.

.3 AWS W1-2015, Welding Inspection Handbook.

.4 CSA Group (CSA)

.1 CSA W48-2018, Filler Metals and Allied Materials for Metal Arc Welding.

.2 CSA B51:19, Boiler, Pressure Vessel and Pressure Piping Code.

.3 CSA-W117.2-12 (R2017), Safety in Welding, Cutting and Allied Processes.

.4 CSA W178.1-2018, Certification of Welding Inspection Organizations.

.5 CSA W178.2-2018, Certification of Welding Inspectors.

.5

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:

.1 Welding qualifications in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Submit welder’s qualifications to DCC Representative.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors:

.1 Inspectors qualified to CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

Part 2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 APPLICATION

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

3.2 QUALITY OF WORK

.1 Welding: in accordance with ANSI/ASME B31.1/B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1.

3.3 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder s identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with DCC Representative.

.2 Formulate Inspection and Test Plan in co-operation with DCC Representative.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

.1 General:

.1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by DCC Representative.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and testmagnetic particle (hereinafter referred to as “particle” tests. and/or spot gamma ray radiographic (hereinafter referred to as radiography) tests.

.2 Hydrostatically test welds to ANSI/ASME B31.1.

.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.4 Failure of visual examinations:

.1 Upon failure of welds by visual examination, perform additional testing as directed by DCC Representativeof total of up to 10 tests.

.5 Full radiographic tests for

.1 Spot radiography:

.1 Conduct spot radiographic tests of up to 10% of welds, selected at random by DCC Representative from welds which would be most difficult to repair in event of failure after system is operational.

.2 Radiographic film:

.1 Identify each radiographic film with date, location, name of welder, and submit to DCC Representative. Replace film if rejected because of poor quality.

.3 Interpretation of radiographic films:

.1 By qualified radiographer.

.4 Failure of radiographic tests:

.1 Extend tests to welds by welder responsible when those welds fails tests.

.6 Magnetic particle tests for

3.6 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor s expense.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Society of Mechanical Engineers (ASME)

.1 ASME B40.100-2013, Pressure Gauges and Gauge Attachments.

.2 ASME B40.200-2013, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.3 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP)

.1 IPMVP 2018 Version.

.4 Green Seal Environmental Standards (GS)

.1 GS-11-2021, Standard for Paints and Coatings.

.2 GS-36-2013, Standard for Commercial Adhesives.

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 thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Test and Evaluation Reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store thermometers and pressure gauges in dry location and in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.

.2 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4

.1 Resistance to shock and vibration.

2.3 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: stainless steel.

2.4 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100, Grade 2A, phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:

.1 Snubber for pulsating operation.

.2 Gasketted pressure relief back with solid front.

.3 Bronze stop cock.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer s written instructions.

.1 Visually inspect substrate in presence of DCC Representative.

.2 Inform DCC Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied

3.2 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 Heat exchangers.

.2 Water-cooled equipment.

.3 Heat rejection radiators

.4 Dishwashers.

.5 DHW tanks.

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as follows:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 Inlet and outlet of liquid side of heat exchangers.

.5 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

.1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01– Mechanical Identification, identifying medium.

3.6 CLEANING

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

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

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

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by thermometer and gauge installation.

END OF SECTION

Part 1 General

1.1 R8LATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B62-17, Specification for Composition Bronze or Ounce Metal Castings.

.2 ASTM B283-20, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.3 ASTM B505/B505M-18, Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS-SP-25-2018, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80-2013, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit following shop drawings:

.1 Valves specified in this section.

.2 Provide a valve schedule and indicate the proposed system(s) where each valve type will be used.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

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

.3 Packaging Waste Management: remove for reuse and clean waste in accordance with Section 01 74 00 – Cleaning.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.2 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.
.2 Discs: one for every 10 valves, each size, minimum 1.
.3 Stem packing: one for every 10 valves, each size, minimum 1.
.4 Valve handles: 2 of each size.
.5 Gaskets for flanges: one for every 10 flanged joints.

.3 Tools:

.1 Furnish special tools for maintenance of systems and equipment.
.2 Include following:
.1 Lubricant gun for expansion joints

Part 2 Products

2.1 MATERIALS

.1 Valves:

.1 Except for specialty valves, to be single manufacturer.
.2 All products to have CRN registration numbers.

.2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
.2 Copper tube systems: Solder ends to ANSI/ASME B16.18.

.3 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.
.2 Bonnet: screwed.
.3 Connections: soldered or screwed with hexagonal shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: non-asbestos.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.

.2 Under 50 mm, screwed:

.1 Rising stem, solid wedge disc, Class 125 (Steam and condensate valves to be Class 200)

.2 Body: bronze with long disc guides.

.3 Disc: solid wedge, bronze to ASTM B283, loosely secured to stem.

.4 Operator: Handwheel.

.3 Under 50 mm, soldered:

.1 Rising stem, solid wedge disc, Class 125 (Steam and condensate valves to be Class 200)

.2 Body: bronze with long disc guides.

.3 Operator: Handwheel.

.4 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: screwed.

.3 Connections: soldered or screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 Under 50 mm, screwed, Class 125 (Steam and condensate valves to be Class 200):

.1 Bronze body and bonnet: screwed bonnet.

.2 Rising stem.

.3 Disc and seat: renewable composition or bronze disc (composition to suit service conditions), regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.4 Operator: Handwheel.

.3 Under 50 mm, soldered, Class 125 (Steam and condensate valves to be Class 200):

.1 Bronze body and bonnet: union bonnet.

.2 Disc and seat: renewable composition or bronze disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: Handwheel.

.5 Ball Valves:

.1 Under 50 mm, screwed to ANSI B1.20.1 with hexagonal shoulders:

.1 Body and cap: cast high tensile bronze to ASTM B62

.2 Pressure rating: Class 125.

.3 Forged brass body and cap, threaded cap, chrome plated ball, PTFE seats, blow out proof stem.

.4 Ball and seat: replaceable stainless steel solid ball and teflon seat.

.5 Ball valves for isolation service shall have a large/full port.

.6 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

.2 Under 50 mm, soldered:

.1 Body and cap: cast high tensile bronze to ASTM B62

.2 Pressure rating: Class 125.

.3 Forged brass body and cap, threaded cap, chrome plated ball, PTFE seats.

.4 Ball and seat: replaceable stainless steel solid ball and teflon seat.

.5 Ball valves for isolation service shall have a large/full port.

.6 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

.6 Circuit Balancing Valves:

.1 Under 50 mm: copper alloy body, screwed, 'Y' pattern globe.

.2 65 mm and over: cast iron body, flanged or grooved, 'Y' pattern globe.

.3 Maximum pressure 1715 kPa and maximum temperature 121°C.

.4 Calibrated balancing valve with memory, positive shut-off, inlet and outlet pressure measuring connections with integral shut-offs and drains.

.5 Calibration charts and adjustment tools to be included.

.6 Provide one (1) differential pressure meter kit suitable for direct readout c/w connection hoses suitable for the system pressure.

Part 3 Execution

3.1 INSTALLATION

.1 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

.2 Remove internal parts before soldering.

.3 Install valves with stems upright or angled 45º above horizontal unless approved otherwise.

.4 Use gate valves or (ball valves NPS 2 and under) to shut off branch takeoffs and to isolate supply and return piping at equipment.

.5 Use globe valves to control flow in circuits; except, where circuit balancing valves are specifically specified or indicated.

.6 Install circuit balance valves in the return piping connections to each terminal heating unit – e.g. unit heaters, heating coils, etc.

.7 Provide isolation valves in all systems such that large branch pipes can be isolated.

.8 Provide valves upstream of all mechanical equipment including meters, gauges, automatic air vents, etc. for isolation purposes.

3.2 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.1-2015, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ASTM International Inc.

.1 ASTM A49-12 (2019). Standard Specification for Heat-Treated Carbon Steel Joint Bars, Microalloyed Joint Bars, and Forged Carbon Steel Compromise Joint Bars

.2 ASTM A126-04 (2014), Standard Specification for Grey Iron Castings for Valves, Flanges, and Pipe Fittings.

.3 ASTM A536-84 (2019), Standard Specification for Ductile Iron Castings.

.4 ASTM B61-15, Standard Specification for Steam or Valve Bronze Castings.

.5 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM B85/B85M-18e1, Standard Specification for Aluminum-Alloy Die Castings.

.7 ASTM B209-21, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS SP-61-2019, Pressure Testing of Steel Valves.

.2 MSS SP-70-2011, Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS SP-71-2018, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS SP-82-1992, Valve Pressure Testing Methods.

.5 MSS SP-85-2011, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

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, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00- Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

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

.3 Packaging Waste Management: remove for reuse or recycling.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.2 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.

.2 Discs: one for every 10 valves, each size, minimum 1.

.3 Stem packing: one for every 10 valves, each size, minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints.

.3 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

2 PRODUCTS

2.1 MATERIAL

.1 Valves:

.1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:

.1 Gate valves: MSS SP-70.

.2 Globe valves: MSS SP-85.

.3 Check valves: MSS SP-71.

.3 Requirements common to valves, unless specified otherwise:

.1 Body, bonnet: cast iron to ASTM B209 Class B or ductile iron to ASTM A536 Grade 65-45-12.

.2 Connections: flanged ends to ANSI B16.1.

.3 Inspection and pressure testing: to MSS SP-82.

.4 Bonnet gasket: non-asbestos.

.5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.

.7 Gland packing: non-asbestos.

.8 Handwheel: die-cast aluminum alloy to ASTM B85/B85M or malleable iron to ASTM A49. Nut of bronze to ASTM B62.

.9 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 65-200 mm, non rising stem, inside screw, bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62.

.3 Seat rings: renewable bronze to ASTM B62, screwed into body.

.4 Stem: bronze to ASTM B62.

.5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.

.6 Seat: integral with body.

.7 Stem: wrought steel.

.8 Operator: handwheel.

.9 Bypass: complete with union and NPS gate or globe valve as Section 23 05 23.01- Valves – Bronze.

.2 65-200 mm, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62 up to 75 mm, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.

.3 Seat rings: renewable bronze screwed into body.

.4 Stem: manganese bronze.

.5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.6 Seat rings: integral with body.

.7 Stem: nickel-plated steel.

.8 Pressure-lubricated operating mechanism.

.9 Operator: handwheel.

.10 Bypass: complete with union and NPS globe or gate valve as Section 23 05 05- Installation of Pipework.

2.3 GLOBE VALVES

.1 65-250 mm, OS&Y:

.1 Body: with multiple-bolted bonnet.

.2 WP: 860 kPa steam, 1.4 MPa CWP.

.3 Bonnet-yoke gasket: non-asbestos.

.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.

.5 Seat ring: renewable, regrindable, screwed into body.

.6 Stem: bronze to ASTM B62.

.7 Operator: handwheel.

.8 Bypass: complete with union and NPS globe or gate valve as Section 23 05 23.01- Valves – Bronze.

2.4 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Size of bypass valve:

.1 Main valve up to 200 mm: 20 mm.

.3 Type of bypass valves:

.1 On gate valve: globe, to Section 23 05 23.01- Valves - Bronze. Pressure rating to match main valve.

.2 On globe valve: globe, to Section 23 05 23.01- Valves - Bronze. Pressure rating to match main valve.

2.5 VALVE OPERATORS

.1 Install valve operators as follows:

.1 Handwheel: on valves except as specified.

.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in mechanical equipment rooms.

2.6 CHECK VALVES

.1 Swing check valves, Class 125:

.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Grooved or flanged ends: plain faced with smooth finish.

.1 Up to 400 mm: ductile iron ASTM A536 Grade 65-45-12 or cast iron to ASTM A126 Class B.

.2 Disc: rotating for extended life.

.1 Up to 150 mm: stainless steel type 316.

.2 200 mm and over: bronze-faced cast iron.

.3 Seat rings: renewable bronze to ASTM B62 screwed into body.

.4 Hinge pin, bushings: stainless steel.

.2 Swing check valves, 65-200 mm Class 250:

.1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.

.2 Flanged ends: 2 mm raised face with serrated finish.

.3 Rating: 250 psi steam; 500 psi CWP.

.4 Disc: rotating for extended life.

.1 Up to 75 mm: bronze to ASTM B61.

.2 100-200 mm: iron faced with ASTM B61 bronze.

.5 Seat rings: renewable bronze to ASTM B61, screwed into body.

.6 Hinge pin, bushings: renewable, bronze to ASTM B61.

.7 Hinge: galvanized malleable iron.

.8 Identification tag: fastened to cover.

2.7 SILENT CHECK VALVES

.1 Construction:

.1 Body: ductile iron with integral seat.

.2 Pressure rating: Class 125, WP = 860 kPa.

.3 Connections: grooved ends.

.4 Disc: stainless steel renewable rotating disc.

.5 Seat: renewable, EPDM.

.6 Stainless steel spring, heavy duty.

3 EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

3.2 CLEANING

.1 Clean installed products in accordance to manufacturer's recommendation.

.2 Waste Management: separate waste materials for reuse or recycling.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Bases, pads, hangers and supports for mechanical piping, ducting and equipment, provided in Divisions 23 and 25.

1.2 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC

1.3 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1-2018, Power Piping.

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

.1 ASTM A125-96(2018), Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-21, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563/A563M-21ee1, Specification for Carbon and Alloy Steel Nuts.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.4 Thermal Insulation Association of Canada (TIAC) Mechanical Insulation Best Practices Guide

1.4 SUBMITTALS

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

.2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada (where stamp is required).

.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and supports to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 and ASME B31.1.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.6 Provide hangers and supports to secure equipment in place, prevent vibration, protect appropriate against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.

.7 Provide insulation protection saddles on all insulated piping.

.8 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP58.

.9 Set inserts in position in advance of concrete work. Use grid system in equipment rooms.

.10 Support from (top of) structural members. Where structural bearings do not exist or inserts are not in suitable locations, suspend hangers from steel channels or angles. Provide supplementary structural members, as necessary.

.11 Do not suspend from metal deck.

.2 Performance Requirements:

.1 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 General Finishes:

.1 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 50 mm maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm ULC listed.

.2 Cold piping 65 mm or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, ULC listed to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping 50 mm maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, ULC listed to MSS SP69.

.2 Cold piping 65 mm or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut ULC listed.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate, ULC listed to MSS SP69.

.5 Steel Joist:

.1 Cold piping 50 mm and under: steel washer plate with double locking nuts.

.2 Cold piping 65 mm and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.

.6 Steel Channel or Angle (bottom):

.1 Cold piping 50 mm and under; malleable iron C clamp.

.2 Cold piping 65 mm and larger and all hot piping; universal channel clamp.

.7 Steel Channel or Angle (top):

.1 Cold piping 50 mm and under: malleable iron "top of beam" C clamp.

.2 Cold piping 65 mm and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer.

.8 Hanger rods: threaded rod material to MSS SP58:

.1 Carbon steel black continuous threaded rod.

.2 Carbon steel black continuous threaded rod with electro-galvanized finish in Level 0 (crawlspace).

.3 Ensure that hanger rods are subject to tensile loading only.

.4 Provide linkages where lateral or axial movement of pipework is anticipated.

.5 Do not use 22 mm or 28 mm rod.

.9 Pipe attachments: material to MSS SP58:

.1 Cold piping, steel or cast iron: hot piping steel, with less than 25 mm horizontal movement; hot piping, steel, with more than 300 mm rod length: adjustable clevis.

.2 Cold copper piping; hot copper piping with less than 25 mm horizontal movement; hot copper piping with more than 300 mm rod length: adjustable clevis copper plated.

.3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25 mm; hot steel piping with middle attachment (rod) 300 mm or less; pipe roller.

.4 Bottom supported hot piping, steel and copper: pipe roller stand.

.5 Spring hangers; where required to offset expansion on horizontal runs which follow long vertical risers.

.6 See Clause 2.4 for insulation shields.

.7 Oversize pipe hangers and supports, for insulated hot pipework, to avoid penetrating the insulation vapour barrier.

.10 Adjustable clevis: material to MSS SP69, ULC listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis, for stiffening during seismic event.

.1 Ensure "U" has hole in bottom for riveting to insulation shields.

.11 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.12 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: black (electro-galvanized finish in Level 0)

.2 Finishes for copper pipework: black, with formed portion plastic coated or epoxy coated.

.13 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, ULC listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 General

.1 On insulated piping larger than 25mm diameter where insulation possesses a continuous vapour barrier, install oversized hangers and insulation protection shields of thickness and length as recommended by the manufactures.

.2 On insulated piping 25mm and less, protect contact between pipe and hanger and fit insulation tightly around hanger rod penetration through insulation.

.2 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Uninterrupted vapour barrier.

.3 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, carbon steel to comply with MSS SP69.

2.5 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.6 WALL SUPPORTS

.1 Horizontal and Vertical pipe adjacent to wall.

.1 Exposed pipe wall support for lateral movement restraint.

.2 Galvanized or other non corrosive finish.

.3 Channel type support - Burndy, Canadian Strut, Cantruss or Unistrut, type support.

.4 Angle iron wall brackets (galvanized or other non corrosive finish) with specified hangers.

2.7 FLOOR SUPPORTS

.1 Horizontal pipe.

.1 Do not support piping from the floor unless specifically indicated.

.2 Vertical pipe.

.1 Mid-point of risers between floor slabs - adjustable fabricated steel supports.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

.2 Submit structural calculations with shop drawings, signed and sealed by professional engineer certified in Ontario.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, vibrating equipment and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below or as indicated, whichever is more stringent.

.1 Plumbing piping: to National Plumbing Code of Canada.

.2 Fire protection: to applicable fire code; toggle hangers are unacceptable.

.3 For Natural Gas Piping refer to Gas Code CAN/CGA-B149.1. Up to 15 mm: every 1.8m.

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300 mm of each horizontal elbow, tee, joints, etc.

Maximum Hanger Spacing Table.

Pipe Size Nominal mm	Rod Diameter mm	Maximum Spacing Steel Pipe	Maximum Spacing Copper Pipe

		m	m
15	10	1.8	1.5
20, 25 1	10	2.4	1.8
32, 40	10	3.0	1.8
50	10	3.0	3.0
65, 75, 100	12	3.0	3.0
125, 150, 200	16	3.0	

.2 Maximum hanger spacing for flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

Maximum Pipe Size : mm	**Maximum Spacing Steel**	**Maximum Spacing Copper**
up to 32	2.1 m	1.8 m
40	2.7 m	2.4 m
50	3.0 m	2.7 m
65	3.6 m	3.0 m
75	3.6 m	3.0 m
100	4.2 m	3.6 m
125	4.8 m	
150	5.1 m	
200	5.7 m	
250	6.6 m	
300	6.9 m	

3.4 HANGER INSTALLATION

.1 Offset hanger so that rod is vertical in operating position.

.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.

.4 Install hanger to provide minimum 12 mm clear space between finished covering and adjacent work.

.5 Support vertical piping at every other floor.

.6 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.7 Where practical, support riser piping independently of connected horizontal piping.

.8 Install plastic inserts between steel studs and piping.

.9 For beam clamps, extend hanger rod tight to underside of beam with top bolt and washer.

3.5 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts, flush with slab surface.

.4 Provide inserts for piping/equipment above chillers, pumps and sump pumps to permit equipment servicing. Provide an eyebolt.

.5 Inserts shall be installed in accordance with manufacturer's recommendations and in no case closer than 2.1 m apart.

3.6 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.7 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.8 FIELD QUALITY CONTROL

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

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.9 CLEANING

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 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 RELATED SECTIONS

.1 Section 09 91 00.08 – Painting for Minor Works

.2 Section 23 05 00 - Common Work Results for HVAC

1.3 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1-20, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-12, Identification of Piping Systems.

1.4 SUBMITTALS

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

.2 Shop drawings to indicate the following:

.1 Legend of proposed identification details for each system.

.2 Details of proposed nameplates, labels and tags.

.3 Samples:

.1 Provide a sample of a typical nameplate, label and tag for review and approval of DCC Representative.

.2 Provide a mock up of each type of piping identification.

.4 Closeout Submittals:

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 70 03 - Safety Requirements.

1.1 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Section 01 74 00 – Cleaning.

.2 Dispose of unused paint and coating material at official hazardous material collections site approved by DCC Representative.

.3 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 GENERAL

.1 Scope of Work includes identification of all mechanical equipment and services within the area of this project.

2.2 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Corrosion resistant metal or lamacoid nameplate, mechanically fastened to each piece of equipment by manufacturer.

.2 Include ULC, (Underwriters' Laboratories Canada) or CSA, (Canadian Standards Association) registration logos and those of other agencies, as required by the respective agencies.

.3 Nameplates shall be located so that they are easily read. Do not insulate or paint over nameplates.

.4 Lettering and numbers raised or recessed.

.5 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.3 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 (lamacoid), matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 8.

.2 Equipment in Mechanical Rooms: use size # 9.

.5 Identify all systems and areas or zones of building being serviced.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1.

.1 Paint all natural gas piping yellow.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from DCC Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Safety valve vent	Yellow	STEAM VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Domestic cold water supply	Green	DOM. CWS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: black, or co-ordinated with base colour to ensure strong contrast.

.3 Ducts label shall have system identifier, duct purpose and flow direction. eg. EF-1 Exhaust →

2.7 VALVES, CONTROLLERS

.1 White lamacoid tags with 12 mm engraved identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 TAGGING IDENTIFICATION

.1 Secure engraved laminated plastic identification tags (black face and white centre) on the following items:

.1 Temperature control instruments, gauges and panels, coordinated with control diagrams identification.

.2 Switchboard breakers supplied under the Mechanical Division 22, 23 and 25.

.3 Refer also to Controls Division 25.

.4 Unit Heaters

.5 All other installed mechanical equipment located indoors

.2 Secure corrosion resistant metal or lamacoid tags suitable for harsh outdoor environments, fastened to the following items:

.1 Air Handling Units

.2 Exhaust Fans

.3 All other installed mechanical equipment located outdoors

2.10 LANGUAGE

.1 Identification in English.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 23 – Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas, in mechanical rooms, equipment rooms, crawlspace: at not more than 7.5m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas, service spaces and walking aisles.

.2 Adjacent to each change in direction greater than 90 degrees.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with UV rated plastic tie wraps.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by DCC Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Testing, Adjusting and Balancing (TAB) is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for all HVAC and plumbing systems in the facility.

.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 RELATED SECTIONS

.1 Section 01 91 00 - Commissioning

.2 Section 23 05 00 - Common Work Results for HVAC

.3 Division 25 – Integrated Automation

1.3 QUALIFICATIONS OF TAB COMPANY AND PERSONNEL

.1 Testing, Adjusting and Balancing Company shall meet the following qualifications:

.1 Proven experience in testing and balancing of mechanical systems, for a variety of industrial processes and systems.

.1 TAB company must be NEBB or AABC certified.

.2 The senior site technologist must have TAB experience of similar industrial projects.

.3 Submit names of personnel to perform TAB to the DCC Representative within 30 days of award of contract.

.4 Provide documentation confirming qualifications, successful experience.

.5 TAB: performed in accordance with the requirements of following standard:

.1 National Environmental Balancing Bureau (NEBB), Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-8th Edition (2015).

.6 Use TAB Standard provisions, including checklists, and report forms; submit final report at the completion of the project. Include report in the maintenance manual.

.7 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.8 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.9 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.4 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 (simulate filter loading, outdoor air provision, etc.)

1.5 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction (such as sprinkler system, fire alarm system, etc.)

1.6 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.

1.7 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to the DCC Representative the adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to the 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.

1.8 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.

1.9 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.

1.10 START OF TAB

.1 Notify DCC Representative seven (7) days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

- .1 Installation of ceilings, doors, windows, other construction affecting TAB.
- .2 Application of weatherstripping, sealing, and caulking.
- .3 Pressure, leakage, other tests specified elsewhere in 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 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

- .1 HVAC systems: plus or minus 5%.
- .2 Hydronic liquid systems: plus or minus 10 %.

1.12 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2% of actual values.

1.13 INSTRUMENTS

.1 Prior to TAB, submit to DCC Representative a 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.

1.14 SUBMITTALS

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

.2 Qualifications of TAB Company and Personnel.

.3 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

.4 Test Reports: submit certified test reports from approved TAB Company indicating compliance with specifications for specified performance characteristics and physical properties. Include as follows:

.1 Pre-TAB review – confirmation of the adequacy of provisions of TAB.

.2 List of any standards or procedures that differ from specified standards.

.3 Preliminary TAB Report.

.4 Statutory declaration certifying that the TAB procedures have been completed.

.5 Fire Damper Test Report.

.6 Final TAB Report.

.5 Quality Control Check Sheet, itemizing all reports and certificates.

1.15 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of DCC Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.16 TAB REPORT

.1 Format in accordance with NEBB Guidelines.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 3 copies of TAB Report to DCC Representative for verification and approval, in English in D-ring binders, complete with index and index tabs.

.4 Include final TAB report in maintenance manual.

1.17 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.

1.18 SETTINGS

.1 After TAB is completed to satisfaction of DCC Representative, replace drive guards, close access doors, lock devices in set positions, and 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.

1.19 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by DCC Representative.

.2 Include final TAB report in the maintenance manual.

1.20 TAB GENERAL

.1 Standard: TAB to most stringent of this section or TAB standards of NEBB.

.2 Do TAB of all mechanical systems, equipment, components, controls, installed in this contract, including:

.1 HVAC Systems including new and existing equipment that is being used to serve spaces within this contract.

.1 Kitchen refrigeration systems heat rejection circuit

.2 Kitchen refrigeration systems heat recovery.

.3 The TAB agency shall be responsible to the Contractor but report jointly to the DCC Representative and the Contractor. Report in writing to the DCC Representative any lack of cooperation and any discrepancies or items not installed in accordance with the contract documents.

.4 Procedures shall be in general accordance with AABC's National Standards for Field Measurement and Instrumentation and ASHRAE Standards.

.5 The TAB agency shall agree to perform spot checks, where requested, in the presence of the DCC Representative.

.6 Work with the TAB agency to:

.1 Ensure that all mechanical systems are complete and ready to be balanced and provide sufficient time for testing and balancing prior to substantial performance.

.2 Make corrections to achieve system balance without delay, include all corrections made during the balancing procedure on "As Built" Drawings. Mechanical Contractor to provide “As Built” information to the balancing agency before balancing commences.

.3 Adjust fan drives and change sheaves and belts as directed by the agency. Allow for the cost of the replacement sheaves and belts.

.4 Maintain all systems in full operation during the complete testing and balancing period.

.5 Employ control technicians to make adjustments to the control systems to facilitate the balancing process.

.6 Employ the journeyman millwright to check the alignment of any V-belt drives and/or shaft coupling drives if they have been adjusted during the balancing process. Belt tension correctness to be verified.

.7 Consult with the DCC Representative to clarify the design intent where necessary or in case there are any problems foreseen as the balancing processes.

.8 Complete air balance before commencing water balance where heating/cooling coils are installed in the air system. Balancing shall not commence until systems have been cleaned and treated and the air removed from within the piping systems.

.9 This TAB agency shall remove and re-install ceiling tile to provide access to ductwork and piping. The TAB agency will make good any damage or soiling caused by his forces.

.10 Permanently mark final settings on valves, dampers and other adjustment devices. Set and lock all memory stop balancing devices.

.11 Seal all holes with snap plugs or approved alternate method, used for flow and pressure measurements.

.12 The controls contractor and TAB agency are to allow for checking and making adjustments during the 12 month warranty period, when weather conditions provide natural loads and in cases where complaints arise.

.13 Submit a draft balance report to the DCC Representative for approval and submit approved copies to the agency preparing the O & M manuals for inclusion in each operating and maintenance manual. Provide field notes in the balancing report to clearly identify unusual conditions, problem areas and report on any cases where the specified flow rates or conditions could not be achieved by adjustment. Identify outstanding problems that cannot be corrected by the balancing team or that will not be corrected by the installing trades (e.g. in cases where additional balancing dampers are required).

.14 Submit a statutory declaration to the DCC Representative, certifying that the testing and balancing procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and, finally, that follow-up testing, after correction of faults and omissions, has been completed and recorded. Reports to be signed by the senior member of the TAB agency.

.15 The Balancing Agency shall include for four (4) days of return visits for readjustment of systems after the building is occupied and used.

1.21 POST-OCCUPANCY TAB

.1 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

.2 Include for two days on site for checking and system balance modifications during each visit.

Part 2 Products

2.1 NOT USED

Part 3 Execution

NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Thermal insulation for mechanical and plumbing piping.

1.2 RELATED SECTIONS

.1 Section 07 84 00 - Fire Stopping

.2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-2019; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM B209-21, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 ASTM C335-M-10e1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-19, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C547-22, Specification for Mineral Fiber Pipe Insulation.

.5 ASTM C553-19, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.6 ASTM C612-14, Specification for Mineral Fiber Block and Board Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): TIAC Mechanical Insulation Best Practices Guide (2013).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-18, Surface Burning Characteristics of Building Materials and Assemblies.

.6 Insulation thickness and insulating values shall be in accordance with NRC Model National Energy Code of Canada for Buildings (MNECB).

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

1.5 SUBMITTALS

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

.2 Submit shop drawings for duct insulation. Include the following:

.1 Pipe insulation: manufacturer's catalogue literature.

.2 Installation requirements.

.3 Pipe insulation finishes, indicating where each finish type will be applied.

.3 Insulation samples (Clause 1.6).

.4 Closeout Submittals:

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 SAMPLES

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.7 QUALIFICATIONS

.1 Installer: specialist in performing work of this section and have successful experience in this size and type of project, qualified to standards of TIAC.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 – Cleaning.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 Insulation, all finishes and jackets shall be in accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 High density insulation: 64 kg/m^3 density insulation.

2.3 PREFORMED PIPE COVERING

.1 TIAC Code A.1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702.

.2 Maximum "k" factor: to CAN/ULC-S702.

.3 Thermal conductivity at 24°C - 0.037 W/m/deg.C.

.2 TIAC Code A.3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.4 Thermal conductivity at 24˚C - 0.037 W/m/deg.C.

.3 TIAC Code A.6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.4 Certified by manufacturer: free of potential stress corrosion cracking corrodents.

2.4 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.5 JACKETS

.1 PVC White Finishing Jacket (minimum 0.50 mm thick):

.1 Proto PVC, Speedline PVC, Zeston PVC.

.2 Canvas:

.1 220 and 120 gm/m² cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

2.6 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Tape: self-adhesive, aluminum, 50 mm wide minimum.

.4 Contact adhesive: quick-setting.

.5 Seal Coating:

.1 White washable, abrasion-resistant indoor fabric insulation coating designed to resist mold and mildew growth. Lasting finish that does not yellow.

.6 Canvas adhesive: washable.

.7 Tie wire: 1.5 mm stainless steel.

.8 Banding: 12 mm wide, 0.5 mm thick stainless steel.

2.7 PREFORMED FITTING COVERS:

.1 PVC Fitting Covers:

.1 0.50 mm thick premoulded one piece covers with specified fire and smoke ratings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: at expansion joints, valves, primary flow measuring elements, flanges and unions at equipment.

.2 Design: to permit movement of expansion joint and permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: PVC.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes piping, valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: SS bands at 300 mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.

.1 Securements: SS bands at 300 mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Securements: SS bands at 300 mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C

.5 Thickness of insulation as listed in following table.

			PIPE INSULATION THICKNESS (MM)				
Service	Design Operating Temp. °C	TIAC CODE	NOMINAL PIPE OR TUBE SIZE (NPS)				
			< 1	1 to < 1½	1½ to < 4	4 to < 8	≥ 8

Service	Design Operating Temp. °C	TIAC CODE	PIPE INSULATION THICKNESS (MM) NOMINAL PIPE OR TUBE SIZE (NPS)				
			< 1	1 to < 1½	1½ to < 4	4 to < 8	≥ 8
	50-90	A-1	25	38	38	38	38
Domestic Cold Water	5	A-3	25	25	25	25	25
Steam	up to 175	A-1	38	50	65	75	90
Condensate Return	60 - 94	A-1	25	38	38	38	38
Pumped Condensate return	up to 94	A-1	25	38	38	38	38
Hot Water Heating	60 - 94	A-1	25	38	38	38	38
Refrigerant Piping (suction and hot gas)	-	A-6	25	25	25	25	25
P-traps off roof cooling units	-	A-3	25	25	25	25	25

3.7 PIPE INSULATION FINISHES

.1 "Concealed" insulation in horizontal and vertical service spaces, including within ceiling spaces will require no further finish.

.2 "Exposed" insulation inside all areas shall be finished as follows:

.1 Over a factory applied integral all-service type jacket on the pipe insulation, apply canvas jacket, complete with seal coating. Finish fabric with one coat of fabric coating that meets specified flame spread and smoke development rating. Alternate white PVC jacket meeting specified flame spread, and smoke requirements is acceptable.

.2 Provide removable insulating jackets on all large serviceable equipment/devices. Where valves, etc., are too small for jackets, apply canvas jacket on valve bodies and all pipe fittings, Finish fabric with one coat of fabric coating that meets specified flame spread and smoke development rating. Alternate over insulated fittings apply PVC fitting covers. Over insulated valve bodies, valve bonnets, strainers and flanges apply prefabricated PVC covers, or neatly fabricate from PVC sheeting secured with solvent bonding cement.

.3 Finish attachments: SS bands, at 150 mm on centre.

.4 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.8 FIRE STOPPING AND SMOKE SEALS

.1 Fire stopping shall be done under Section 07 84 00 - Fire Stopping.

.2 Maintain insulation around pipes penetrating fire separation only as permitted by Firestop Assembly Listing.

3.9 INSULATION PACKING OF PIPE SLEEVES

.1 Tightly pack the space between all pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation, to full depth of sleeve to prevent transmission of sound and/or passage of smoke.

3.10 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes

.1 Performance verification of mechanical piping systems.

1.2 RELATED SECTIONS

.1 Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

1.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.

.2 Pressure bypass open/closed.

.3 Control pressure failure.

.4 Maximum heating demand.

.5 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.5 HYDRONIC SYSTEM CAPACITY TEST

.1 Perform hydronic system capacity tests after:

.1 TAB has been completed

.2 Verification of operating, limit, safety controls.

.3 Verification of primary and secondary pump flow rates.

.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

1.6 REPORTS

.1 Provide reports for all tests, in accordance with Section 01 91 00 – Commissioning, supplemented as specified herein.

1.7 TRAINING

.1 In accordance with Section 01 91 00 – Commissioning, supplemented as specified herein.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 RELATED SECTIONS

.1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.3 SUBMITTALS

.1 Shop Drawings:

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

.2 Include product literature, specifications, product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 70 03 - Safety Requirements.

1.5 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 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 Cleaning.

Part 2 Products

2.1 CLEANING SOLUTIONS

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 CLEANING HYDRONIC SYSTEMS

.1 Clean all piping and fittings installed in this contract.

.2 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.3 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems:

.1 Systems: free from construction debris, dirt and other foreign material.

.2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers: clean prior to initial fill.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning:

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems

.1 Fill system with water, ensure air is vented from system.

.2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).

.3 Use water metre to record volume of water in system to +/- 0.5%.

.4 Add chemicals under direct supervision of chemical treatment supplier.

.5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.

.6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.

.7 Add chemical solution to system.

.8 Establish circulation, raise temperature slowly to 82 degrees C minimum. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 hours at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).

3.3 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning of existing and new piping is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.

.2 Ensure air is removed.

.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

.5 Clean out strainers repeatedly until system is clean.

.6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment.

.7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.

.8 Repeat with water at design temperature.

.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.10 Bring system up to design temperature and pressure over a 48 hour period.

.11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.12 Adjust pipe supports, hangers, springs as necessary.

.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.15 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.16 Check operation of drain valves.

.17 Adjust valve stem packings as systems settle down.

.18 Fully open balancing valves (except those that are factory-set).

.19 Check operation of over-temperature protection devices on circulating pumps.

.20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for copper piping and fittings for hydronic systems.

1.2 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC

.2 Section 23 05 23.01 - Valves – Bronze

.3 Section 23 08 02 - Cleaning and Start-Up

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)

.1 ANSI/AWS A5.8/A5.8M-11, AMD1 Specification Filler Metals for Brazing and Braze Welding.

.2 ASME

.1 ANSI/ASME B16.4-16, Gray-Iron Threaded Fittings Classes 125 and 250.

.2 ANSI/ASME B16.15-18, Cast Copper Alloy Threaded Fittings Classes 125 and 250.

.3 ANSI B16.18-18, Cast Copper Alloy, Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22-18, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.3 ASTM International (ASTM)

.1 ASTM B32-08 (2014), Standard Specification for Solder Metal.

.2 ASTM B61-15, Standard Specification for Steam or Valve Bronze Castings.

.3 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.

.4 ASTM B88M-18, Standard Specification for Seamless Copper Water Tube (Metric).

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

.1 Safety Data Sheets (SDS).

.5 Manufacturers Standardization Society (MSS)

.1 MSS SP67-2017, Butterfly Valves.

.2 MSS SP70-2011, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS SP71-2018, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS SP80-2013, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS SP85-2011, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.4 SUBMITTALS

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

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

.1 Include the following:

.1 Piping type and fittings

.3 Closeout Submittals.

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal.

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 – Cleaning.

Part 2 Products

2.1 TUBING

.1 Type L hard drawn copper tubing: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15.

.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.

.3 Cast iron threaded fittings: to ANSI/ASME B16.4.

.4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

2.3 FLANGES

.1 Brass or bronze: threaded.

.2 Cast iron: threaded.

.3 Orifice flanges: slip-on, raised face, 2100 kPa.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32.

.2 Silver solder BCUP: to ANSI/AWS A5.8.

.3 Brazing: as indicated.

2.5 VALVES

.1 Connections:

.1 NPS 2 and smaller: ends for soldering.

.2 NPS 2 1/2 and larger: grooved ends.

.2 Gate Valves: application: isolating equipment, control valves, pipelines :

.1 NPS 2 and under:

.1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 1/2 and over:

.1 Mechanical Rooms: rising stem, split wedge disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.

.2 Elsewhere: Non-rising stem, solid wedge disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.

.3 Globe valves: application: throttling, flow control, emergency bypass :

.1 NPS 2 and under:

.1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 Elsewhere: globe, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 1/2 and over:

.1 With composition disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.

.4 Balancing, for TAB:

.1 Sizes: calibrated balancing valves, as specified.

.2 NPS 2 and under:

.1 Mechanical rooms: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 Elsewhere: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.

.5 Drain valves: gate, Class 125, as specified Section 23 05 23.01 - Valves - Bronze.

.6 Swing check valves:

.1 NPS 2 and under:

.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 1/2 and over:

.1 Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.7 Silent check valves:

.1 NPS 2 and under:

.1 As specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 1/2 and over:

.1 Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.8 Ball valves:

.1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PIPING INSTALLATION

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.3 Slope piping in direction of drainage and for positive venting.

.4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.6 Assemble piping using fittings manufactured to ANSI standards.

3.3 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install ball or gate valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.3 Install globe valves for balancing and in by-pass around control valves as indicated.

.4 Install silent check valves on discharge of pumps, in vertical pipes with downward flow and as indicated.

.5 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.6 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Mechanical Equipment Rooms.

3.4 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.5 FLUSHING AND CLEANING

.1 Flush and clean in presence of DCC Representative.

.2 Flush after pressure test for a minimum of 4h.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.

.4 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.

.5 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.

.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.

.7 Re-install strainer screens/baskets only after obtaining DCC Representative's approval.

.8 Refer to Section 23 08 02 - Cleaning and Start-Up.

3.6 FILLING OF SYSTEM

.1 Refill system with clean water adding water treatment as specified.

3.7 FIELD QUALITY CONTROL

.1 Testing:

.1 Fill piping system with water and apply a preliminary test pressure of 172 kPa. Purge all air from piping. If leaks are detected, relieve pressure and correct the leak(s).

.2 Apply hydrostatic pressure in increments of 172 kPa, until maximum test pressure is reached.

.3 Minimum test pressure is 1.5 x design pressure or 860 kPa, whichever is greater.

.4 Maximum test pressure is less than any system component rating under test.

.5 Hold pressure for 24 hours and confirm no leaks and that pressure is maintained.

.6 Submit test report to DCC Representative.

.2 Balancing:

.1 Refer to Section 23 05 93 – Testing, Adjusting and Balancing for HVAC, for applicable procedures.

3.8 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for steel piping, valves and fittings for hydronic systems.

1.2 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC

.2 Section 23 05 23.01 - Valves – Bronze

.3 Section 23 08 02 - Cleaning and Start-Up

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B16.1-2020, Gray Iron Pipe Flanges and Flanged Fittings.
.2 ASME B16.3-2021, Malleable Iron Threaded Fittings.
.3 ASME B16.5-2020, Pipe Flanges and Flanged Fittings.
.4 ASME B16.9-2018, Factory-Made Wrought Buttwelding Fittings.
.5 ASME B18.2.1-2012 (R2021), Square and Hex Bolts and Screws (Inch Series).
.6 ASME B18.2.2-2022, Square and Hex Nuts (Inch Series).
.7 ASME B31.1-2020, Power Piping.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A47-1999, Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
.3 ASTM A536-84 (2019)e1, Standard Specification for Ductile Iron Castings.

.3 American Water Works Association (AWWA).

.1 AWWA C111-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

1.4 SUBMITTALS

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

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

.1 Include the following:
.1 Piping type and fittings

.3 Closeout Submittals.

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal.

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 – Cleaning.

Part 2 Products

2.1 PIPE

.1 Steel Pipe:

.1 Schedule 40 to ASTM A53 Grade B.

.2 Use for the following systems:

.1 Hot water heating

2.2 PIPE JOINTS – STEEL PIPING

.1 NPS 2 and under: screwed fittings, except where otherwise noted, with PTFE tape and rectroseal PTFE paste.

2.3 PIPE FITTINGS – STEEL PIPE

.1 Pipe fittings, screwed or welded:

.1 Cast iron screwed fittings: Class 125 to ANSI B16.3.

.2 Steel butt-welding fittings: to ANSI B16.9a.

.3 Unions, malleable iron ground joint type: Class 150 to ASME B16.3.

2.4 **VALVES**

.1 Connections:

.1 NPS 2 and smaller: screwed ends.

.2 Ball valves:

.1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PIPING INSTALLATION

.1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly. Remove foreign material from piping.

.2 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.

.3 Screw or weld (unless otherwise specified) all piping systems up to NPS 2.

.4 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.5 Use long radius elbows.

.6 Remake leaking joints using new materials, do not caulk or cement leaking threaded joints.

.7 Use eccentric reducers at pipe size changes, flush on top side, to permit positive venting and drainage.

.8 Do not use thread protection couplings, close nipples, running nipples or street elbows.

.9 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.10 Assemble piping using fittings manufactured to ANSI standards.

3.3 CONNECTIONS TO EQUIPMENT AND TO EXISTING PIPING

.1 Install unions at connections to all equipment and at all connecting points to existing systems.

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise noted.

.3 Arrange piping connections to allow ease of access and for removal of equipment.

3.4 VALVE INSTALLATION

.1 Replace existing isolation valves with new gate or ball valves at branch supply and return to each piece of heating convector. Install new control valves as indicated.

3.5 FLUSHING AND CLEANING

.1 Flush and clean in presence of DCC Representative.

.2 Flush after pressure test for a minimum of 4h.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.

.4 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.

.5 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.

.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.

.7 Re-install strainer screens/baskets only after obtaining DCC Representative's approval.

.8 Refer to Section 23 08 02 - Cleaning and Start-Up.

3.6 FILLING OF SYSTEM

.1 Refill system with clean water, adding water treatment as specified.

3.7 FIELD QUALITY CONTROL

.1 Testing:

.1 Fill piping system with water and apply a preliminary test pressure of 172 kPa (25psig). Purge all air from piping. If leaks are detected, relieve pressure and correct the leak(s).

.2 Apply hydrostatic pressure in increments of 172 kPa (25 psig), until maximum test pressure is reached.

.3 Minimum test pressure is 1.5 x design pressure or 860kPa (125 psig), whichever is greater.

.4 Maximum test pressure is less than any system component rating under test.

.5 Hold pressure for 24 hours and confirm no leaks and that pressure is maintained.

.6 Submit test report to DCC Representative.

.2 Balancing:

.1 Refer to Section 23 05 93 – Testing, Adjusting and Balancing for HVAC, for applicable procedures.

3.8 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 74 00 - Cleaning

1.2 REFERENCE STANDARDS

.1 ASME

.1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2019.

.2 ASTM International (ASTM)

.1 ASTM A47/A47M-2014, Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A278/A278M-01 (2015), Standard Specification for Grey Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).

.3 ASTM A516/A516M-17, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.

.4 ASTM A536-84 (2019), Standard Specification for Ductile Iron Castings.

.5 ASTM B62 (2017), Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 CSA Group (CSA)

.1 CSA B51-19, Boiler, Pressure Vessel, and Pressure Piping Code.

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 expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic specialties for incorporation into manual.

.3 Submit

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.

.2 Store and protect hydronic specialties from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DIAPHRAGM TYPE EXPANSION TANK

.1 Vertical pressurized diaphragm type expansion tank.

.2 Capacity as per schedule.

.3 Diaphragm sealed in EPDM suitable for 115 degrees C operating temperature.

.4 Working pressure: 860 kPa with ASME stamp and certification.

.5 Air precharged to initial fill pressure of system.

.6 Base mount for vertical installation.

.7 Supports: provide supports with hold down bolts and installation templates.

.8 Renewable diaphragm.

2.2 AUTOMATIC AIR VENT

.1 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.

.2 Float: solid material suitable for 115 degrees C working temperature.

2.3 AIR SEPARATOR - EXPANSION TANK FITTING

.1 Complete with adjustable vent tube and built-in manual vent valve.

.2 Working pressure: 860 kPa.

2.4 COMBINATION SEPARATORS/STRAINERS

.1 Steel, tested and stamped in accordance with ASME BPVC, for 860 kPa operating pressure, with galvanized steel integral strainer with 5 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.5 PIPELINE STRAINER

.1 NPS 1/2 to 2: bronze body to ASTM B62, solder end connections, Y pattern.

.2 NPS 2 1/2 to 12: flanged cast iron body to ASTM A278/A278M, Class 30 connections.

.3 Blowdown connection: NPS 1.

.4 Screen: stainless steel with 1.19 mm perforations.

.5 Working pressure: 860 kPa.

2.6 SUCTION DIFFUSER

.1 Body: cast iron with flanged connections.

.2 Strainer: with built-in, disposable 1.19 mm mesh, low pressure drop screen and NPS 1 blowdown connection.

.3 Permanent magnet particle trap.

.4 Full length straightening vanes.

.5 Pressure Grey tappings.

.6 Adjustable support leg.

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 data sheets.

3.2 GENERAL

.1 Run drain lines and blow off connections to terminate above nearest drain.

.2 Maintain adequate clearance to permit service and maintenance.

.3 Should deviations beyond allowable clearances arise, request and follow DCC Representative’s directive.

.4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.3 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve except at radiation larger than NPS 1.

3.4 AIR VENTS

.1 Install at high points of systems.

.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

3.5 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.

.2 Install lockshield type valve at inlet to tank.

3.6 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

3.7 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 75 mm.

3.8 CLEANING

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

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

Section 01 33 00 – Submittal Procedures

1.2 REFERENCE STANDARDS

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IES Standard 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Electrical Equipment Manufacturers Association of Canada (EEMAC)

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1-2021, Motors and Generators.

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 pump, circulator, and equipment and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.

.3 Shop Drawings:

.1 Submit manufacturer s detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

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 hydronic pumps for incorporation into manual.

.3 Submit

1.5 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 in dry location and in accordance with manufacturer’s recommendations in clean, dry, well-ventilated area.

.2 Store and protect hydronic pumps from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Size and select components to: CAN/CSA-B214.

2.2 IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.

.2 Impeller: stainless steel.

.3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135 degrees C.

.5 Coupling: flexible self-aligning.

.6 Motor: drip proof, to NEMA MG 1

.7 Capacity: per schedule

.8 Design pressure: 860 kPa.

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 data sheets.

3.2 INSTALLATION

.1 Install hydronic pumps to: CAN/CSA-B214.

.2 In line circulators: install as indicated by flow arrows.

- .1 Support at inlet and outlet flanges or unions.
- .2 Install with bearing lubrication points accessible.

.3 Base mounted type: supply templates for anchor bolt placement.

- .1 Include anchor bolts with sleeves. Place level, shim unit and grout.
- .2 Align coupling in accordance with manufacturer s recommended tolerance.
- .3 Check oil level and lubricate. After run-in, tighten glands.

.4 Ensure that pump body does not support piping or equipment.

- .1 Provide stanchions or hangers for this purpose.
- .2 Refer to manufacturer s installation instructions for details.

.5 Pipe drain tapping to floor drain.

.6 Install volute venting pet cock in accessible location.

.7 Check rotation prior to start-up.

.8 Install pressure gauge test cocks.

3.3 START-UP

.1 General:

.1 In accordance with Section 01 91 00 - Commissioning; supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Check base for free-floating, no obstructions under base.

.5 Run-in pumps for 12 continuous hours minimum.

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer s recommendation.

.10 Adjust alignment of piping and conduit to ensure true flexibility.

.11 Eliminate cavitation, flashing and air entrainment.

.12 Adjust pump shaft seals, stuffing boxes, glands.

.13 Measure pressure drop across strainer when clean and with flow rates as finally set.

.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

3.4 PERFORMANCE VERIFICATION (PV)

.1 General:

.1 Verify performance in accordance with Section 01 91 00 – Commissioning; supplemented as specified herein.

.2 Verify that manufacturer's performance curves are accurate.

.3 Ensure valves on pump suction and discharge provide tight shut-off.

.4 Net Positive Suction Head (NPSH):

.1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.

.2 Measure using procedures prescribed in Section 01 91 00 – Commissioning.

.3 Where procedures do not exist, discontinue PV, report to DCC Representative and await instructions.

.5 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.6 Commissioning Reports: in accordance with Section 01 91 00 – Commissioning supplemented as specified herein. Reports to include:

.1 Record of points of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.

.2 Pump performance curves (family of curves).

3.5 CLEANING

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

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

.1 ASME

.1 ASME B16.22-18, 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 B31.5-19, Refrigeration Piping and Heat Transfer Components.

.2 ASTM International

.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

.1 CSA B52-18, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

.1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting one (1) week prior to beginning on-site installation, 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.

1.4 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 refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two (2) copies of WHMIS SDS. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

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 refrigerant piping for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect refrigerant piping, fittings and equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, type B.

.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 2070 kPa and temperature 121 degrees 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.

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 refrigerant piping installation in accordance with manufacturer's written instructions.

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 datasheet.

3.3 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05-Installation of Pipework.

3.4 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.5 PIPING INSTALLATION

.1 General:

.1 Hard drawn copper tubing: do not bend. Minimize use of fittings

.2 Soft annealed copper tubing: bend without crimping or constriction.

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.

.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.

.3 Provide inverted deep trap at top of risers.

.4 Provide double risers for compressors having capacity modulation.

.1 Large riser: install traps as specified.

.2 Small riser: size for 5.1 m3/s at minimum load. Connect upstream of traps on large riser.

3.6 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.

3.7 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees 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.

.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 During progress of Work at 25% complete.

.2 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to DCC Representative.

3.8 DEMONSTRATION

.1 Instructions:

.1 Post instructions in frame with glass cover in accordance with Section 01 78 00- Closeout Submittals and CSA B52.

3.9 CLEANING

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code, 2019.

.2 CSA Group (CSA)

.1 CSA B51-19, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit 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 heat exchangers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Shop drawings to indicate project layout, including layout and dimensions of heat exchangers and system.

.1 Indicate manufacturer s recommended clearances for tube withdrawal and manipulation of tube cleaning tools.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer s Instructions: submit manufacturer s installation instructions.

.7 Manufacturers Reports:

.1 Manufacturer s Field Reports: submit manufacturer s written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

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 heat exchangers for incorporation into manual.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.1 Supply following spare parts:

.1 Head gaskets

1.5 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 in dry location and in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.

.2 Store and protect heat exchangers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Tube-in-shell Heat Exchanger:

.1 Glycol solution to water: Heating media in shell, 4 pass design.

.2 Designed, constructed and tested in accordance with CSA B51 and provincial pressure vessel regulations.

.3 Designed and certified for domestic water usage.

.4 Shell: carbon steel. Tappings for relief valve, gauge, drain, vacuum breaker.

.5 Head: 316 stainless steel, screwed inlet and outlet. Tapped connections for drain and vacuum breaker.

.6 Tubes: copper double wall, with tube support. Maximum tube velocity: 2.3 m/s].

.7 Tube sheet: carbon steel (tube side), 316 SS (shell side).

.8 Fouling Resistance Coefficient: shell side 0.00018 m^2K/W; tube side 0.0000018 m^2K/W.

.9 Capacity: as indicated on schedule.

.10 Working pressure: shell 1034 kPa, tubes 860 kPa.

.11 Mounting supports: steel or cast iron saddles

.12 Piping connections: as indicated on schedule.

.13 Dimensions: as indicated on schedule

Part 3 Execution

3.1 INSTALLATION

.1 Manufacturer s Instructions: comply with manufacturer s written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 General: install level and firmly anchored to supports in accordance with manufacturer s recommendations.

.3 Tube in shell heat exchangers: arrange piping so that tube bundle can be removed after disconnecting two unions or flanges adjacent to head and without disturbing other equipment and systems.

3.2 APPURTENANCES

.1 Install with safety relief valve piped to drain steam trap, hose bib drain valve and vacuum breaker.

.2 Install thermometer wells with thermometers on inlet and outlet of secondary side.

.3 Install pressure gauge on inlet and outlet.

3.3 FIELD QUALITY CONTROL

.1 Site Tests and Inspections:

.1 Perform tests as directed by DCC Representative to ensure heat exchangers are functional.

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

.2 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

.3 Manufacturer s Field Services:

.1 Submit manufacturer s field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer s instructions.

.2 Ensure manufacturer’s representative is present before and during testing.

.3 Schedule site visits:

.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.

3.4 SYSTEM START-UP

.1 General: perform start-up operations in accordance with Section 01 91 00 - Commissioning, supplemented as specified herein.

.2 Check heater for cleanliness on primary and secondary sides.

.3 Check water treatment system is complete, operational and correct treatment is being applied.

.4 Check installation, settings, operation of relief valves and safety valves.

.5 Check installation, location, settings and operation of operating, limit and safety controls.

.6 Check supports, seismic restraint systems.

.7 General: perform performance verification in accordance with Section 01 91 00 - Commissioning, supplemented as specified.

.8 Timing: only after TAB of hydronic systems have been successfully completed.

.9 Primary side:

.1 Measure flow rate, pressure drop, and steam pressure and temperature at heater inlet.

.1 Verify operation of steam traps. Measure temperature of condensate return at trap outlet.

.2 Control valve: verify proper operation without binding, slack in components. Measure steam pressure and temperature at control valve inlet.

.3 Secondary side:

.1 Measure flow rate, pressure drop and water temperature at heater inlet and outlet.

.2 Verify installation and operation of air elimination devices.

.4 Calculate heat transfer from primary and secondary sides.

.5 Simulate heating water temperature schedule and repeat above procedures.

.6 Verify settings, operation, safe discharge from safety valves and relief valves.

.7 Verify settings, operation of operating, limit and safety controls and alarms.

.8 Reports:

.1 In accordance with Section 01 91 00 – Commissioning, supplemented as specified herein.

3.5 CLEANING

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

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

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

3.6 DEMONSTRATION

.1 Training: provide training in accordance with Section 01 91 00 - Commissioning.

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by heat exchanger installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A48/A48M (2022), Standard Specification for Grey Iron Castings.

.2 ASTM A123/A123M (2017), Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A153/A153M (2016), Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM B117 (2019), Standard Practice for Operating Salt Spray (Fog) Apparatus.

.5 ASTM C67 (2021), Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

.6 ASTM D520 (2019), Standard Specification for Zinc Dust Pigment.

.2 CSA Group (CSA)

.1 CSA B52-18, Mechanical Refrigeration Code

.2 CSA C22.2 No 236-15 standard for Heating and Cooling Equipment

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1-2021, Motors and Generators.

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

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Connections, piping, fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring as assembled and schematically.

.3 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.

.4 Vibration and seismic control measures.

.5 Manufacturers recommended clearances.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Test reports:

.1 Submit certified test reports for closed circuit coolers from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

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 coolers for incorporation into manual.

.3 Include:

.1 Description of equipment giving manufacturers name, type, model year, capacity.

.2 Start-up and commissioning procedures.

.3 Details of operation, servicing and maintenance.

.4 Recommended spare parts list.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Include with data complete list of parts and supplies, recommended spare parts list for 1 year of operation, and list of parts recommended by manufacturer to be replaced on routine basis.

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 off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect cooling equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 The drycooler shall be a factory-assembled unit, complete with integral electrical panel, designed for outdoor installation and vertical airflow only. The drycooler shall be a draw-through design.

.2 The drycooler shall have a total heat rejection capacity, design outdoor ambient temperature, entering glycol temperature and a glycol flow rate per schedule data.

.3 The unit is to be supplied for operation using a 575 Volt/3 phase/60 Hz power supply..

2.2 STANDARD FEATURES

.1 The drycooler shall consist of drycooler coil(s), housing, propeller fan(s) direct driven by individual fan motor(s), electrical controls and mounting legs. The air-cooled drycooler shall provide glycol temperature control to the indoor compressor units by adjusting heat rejection capacity.

2.3 MATERIALS

.1 Steel: components fabricated of zinc-coated steel not lighter than 1.5 mm thick steel, protected against corrosion by zinc coating.

.1 Zinc coating: to ASTM A 153/A 153M and ASTM A 123/A 123M, with extra heavy coating of not less than 0.76 kg per square metre of surface.

.2 Coat galvanized surfaces damaged due to welding with zinc rich coating conforming to ASTM D 520, Type 1

.2 Hardware: Galvanized or Type 304 stainless steel.

.1 Bolts: provided with galvanized or stainless steel washers under heads.

.2 Hardware: meet salt-spray fog test as defined by ASTM B 117

2.4 COIL SECTION

.1 The coil shall be constructed of copper tubes in a staggered tube pattern. Tubes shall be expanded into continuous, corrugated aluminum fins. The fins shall have full-depth fin collars completely covering the copper tubes, which are connected to heavy wall Type “L” headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coil shall be split flow into multiple coil circuits. The supply and return lines shall be spun shut and shall include a factory-installed Schrader valve. Coils shall be factory leak-tested at a minimum of 2.1 MPa, dehydrated, then filled and sealed with an inert gas holding charge for shipment. Field relief of the Schrader valve shall indicate a leak-free coil.

2.5 HOUSING

.1 The drycooler housing shall be constructed of bright aluminum sheet and divided into individual fan sections by full-width baffles. Structural support members, including coil support frame, motor and drive support, shall be galvanized steel for strength and corrosion resistance. Aluminum legs shall be provided to mount unit for vertical air discharge and shall have rigging holes for hoisting the unit into position. An electrical panel shall be inside an integral NEMA 3R weatherproof section of the housing. The electrical panel shall provide at least 5,000A SCCR.

2.6 FANS

.1 The propeller fan(s) shall have aluminum blades secured to a corrosion protected steel hub. Fans shall be secured to the fan motor shaft by means of a keyed hub and dual setscrews. Fans shall be factory-balanced and run before shipment.

.2 Fan drive: V-belt designed for minimum 150% of motor nameplate ratings.

.3 The fan motor(s) shall be continuous air-over design and shall be equipped with a rain shield and permanently sealed bearing. Motors shall be rigidly mounted on die-formed galvanized steel supports.

.4 Drives, fans, and moving parts: heavy gauge, close-mesh steel wire guards with galvanized or corrosion-resistant polyester paint finish rated to pass a 1000-hour salt spray test.

2.7 CONTROLS

.1 Electrical Controls

.1 Electrical controls, overload protection devices and service connection terminals shall be provided, and factory wired inside the integral electrical panel section of the housing. A locking disconnect switch shall be factory mounted and wired to the electrical panel and controlled via an externally mounted locking door handle. An indoor unit interlock circuit shall enable drycooler operation whenever indoor unit compressors are active. Only supply wiring, indoor unit interlock wiring and high voltage wiring to pumps when controlled by the drycooler shall be required at drycooler installation.

.2 Fan Cycling Control

.1 The drycooler controller shall sense the leaving glycol temperature and cycle fixed speed fans to maintain glycol temperatures. Aquastats shall have field adjustable setpoints. The fixed speed motors shall be three phase and have individual internal overload protection. Fixed speed motors shall have a TEAO enclosure and a full speed of 1140rpm @ 60Hz.

.3 Pump Control

.1 The drycooler shall control operation of glycol pump(s) powered from the electrical panel.

.2 The control for pump(s) shall be incorporated into the drycooler electrical. The pump fuses, overload heaters and flow switch (dual pump control mode) for the drycooler electrical panel shall be included with the drycooler OEM pump packages or shall be field-supplied for field-supplied pumps.

.3 Dual pump control option shall provide controls for primary and standby pump operation. A flow switch shall be field installed into glycol piping and wired into the drycooler electrical panel. A loss of glycol flow shall be sensed by the flow switch and the pump controls shall energize the standby pump and de-energize the primary pump. An internal switch shall allow manual selection of the lead/lag pump for the balance of run time.

2.8 ACCESSORIES

.1 An expansion tank shall be provided for expansion and contraction of the glycol fluid due to temperature change in the closed system. The tank and air vents shall be field installed at the system’s highest elevation to allow venting of trapped air. A fluid pressure relief valve shall be provided for system safety. The system shall include bladder type diaphragm tank, air separator, air vent, fluid pressure relief valve, pressure gauges, flow switches, tempering valves, primary and standby pumps, supply and return piping.

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 condensers, coolers and cooling tower installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of DCC Representative.

.2 Inform DCC Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Mount on structural supports and vibration isolators as indicated and to manufacturer's recommendations.

.2 Ensure clearance for servicing and maintenance as recommended by manufacturer.

.3 Manufacturers field service representative to approve installation, to start up and to instruct operators.

3.3 FIELD QUALITY CONTROL

.1 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 visit for inspection of product installation in accordance with manufacturer's instructions.

3.4 ADJUSTING

.1 Lubricate bearings with oil or grease as recommended by manufacturer.

3.5 CLEANING

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

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

.2 Wipe equipment clean, and remove traces of oil, dust, dirt, or paint spots.

.3 Maintain system in clean condition until final acceptance.

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

.5 Separate waste materials for reuse and recycling. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

Part 1 General

1.1 SECTION INCLUDES

.1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters, sensors, controls, meters, switches, transducers, dampers, damper operators, valves, valve actuators and low voltage current transformers.

.2 Section also includes non-EMCS control devices. Include for all mechanical controls (EMCS and non-EMCS) within overall Division 25 scope of work.

1.2 RELATED SECTIONS

.1 Section 07 84 00 - Fire Stopping

.2 Section 26 05 00 - Common Work Results for Electrical

1.3 REFERENCES

.1 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-2014, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-18-2021, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 – EMCS: Submittals and Reviews. Shop drawings to include all field control devices.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof assembly.

.3 Operating conditions: 0 – 32°C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as indicated in I/O summary.

2.2 CURRENT SENSING (CR)

.1 Design: Nelsen-Kuljian; Greystone, Veris, RIB (Functional Devices).

.2 Range: 0-120 amps.

.3 Accuracy: +/-1%.

.4 Split core type.

.5 Interface care:

.1 +/-1% accuracy.

.2 Integral zero and span adjustment.

.3 1-5 VDC or 4-20 mA output for full range input.

2.3 CONTROL VALVES (GENERAL)

.1 Body: globe style or characterized ball.

.2 All characteristics of control valves shall be suited to the required application (i.e. water or steam). Three-way mixing valves shall be linear for each port giving constant flow, and two-way valves shall have modified linear flow characteristics. Characterizing discs in valve ports are acceptable.

.3 All valves shall be plug type with stainless steel stems and EPT ring pads or teflon packing.

.4 Valve pressure / temperature rating - minimum ANSI Class 125.

.5 Plugs shall be brass with molded composition discs.

.6 Discs (renewable) shall be bronze for media 110°C or less and stainless steel for media above 110°C operating temperature.

.7 Valve bodies for NPS ½ shall be screwed cast brass with integral seat.

.8 Valves NPS ¾ to NPS 2 shall have screened cast brass body and cast brass cage with integral seat.

.9 Valve bodies for NPS 2½ and up shall be cast iron flanged.

.10 Normally open or Normally closed, as indicated.

.11 Note:

.1 Size control valves according to capacities and pressure drops as indicated in the schedules.

.2 Clearly identify the control valve coefficient (Cv) rating on valve bodies.

.3 All primary building heating valves shall fail open to heating (valves on terminal units may fail either open or to the last operating position). Cooling valves shall fail closed to cooling or to the last operating position. Domestic hot water heating valves shall fail closed to heating. Steam valves shall fail to closed on the heat exchangers and the domestic water heater as scheduled on the drawings.

.4 Control valves to be supplied by this trade for installation by Division 23.

2.4 CONTROL VALVE ACTUATORS

.1 General:

.1 Valve operators shall allow smooth operation of the valve throughout its entire range and assure tight shut-off against system pressure.

.2 Valve actuator shall be easily removed from the valve body for replacement.

.3 Refer to control valve schedule for actuator operation.

.2 Electric Two Position Valve Actuators:

.1 Two Position Control Valve Actuators

.1 Two Position Control Valve Actuators shall include spring return to normal position.

.2 End switches for status indication.

.3 Proportional Control Valve Actuators:

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 0-10 VDC or 4-20 mA control signal. The actuator shall remain in its position until the applied signal changes. In the event of a control signal loss, the actuator shall move to the zero voltage input position.

.2 The valve shall maintain its shutoff force even if power is lost.

.3 Position indication (feedback signal).

2.5 DIFFERENTIAL PRESSURE TRANSMITTERS (DPT)

.1 Provide differential pressure transmitters having the following minimum specifications:

.1 Internal materials to be suitable for continuous contact with the process material measured including compressed air, water, glycol or steam as applicable.

.2 Output signal of 4 - 20 mA into a maximum of 500 ohm load.

.3 Output variations of less than 0.2% full scale for supply voltage variations of +/- 10%.

.4 Combined non-linearity, repeatability and hysteresis effects not to exceed +/- 1% of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effect of +/- 1.5% full scale/50°C or less.

.7 Output short circuit and open circuit protection.

.8 Over-pressure input protection to a minimum of twice rated input.

.9

2.6 END SWITCHES (ESW)

.1 Provide CSA approved end switches on control dampers where required by sequence of operation and/or points list.

.2 End switches shall provide positive status indication of full open and full closed blade position. Provide 2 switches per damper if necessary.

2.7 ELECTRIC RELAYS (ER)

.1 Provide DPDT relays for control and status indication of alarms and/or electrical starters and equipment.

.2 Relay coils shall be rated for 120V or 24V. Where other voltages occur provide transformer.

.3 Contacts rated at 5 amps at 120V AC.

.4 Relays to be plug in type with termination Base.

.5 Relay to have visual status indication

2.8 FLOW SWITCHES (FSW)

.1 Minimum Requirements:

.1 Single pole double throw action (vapour proof on chilled water).

.2 Adjustable sensitivity.

.3 Extended trimmable paddles.

.4 Selected for minimum flow condition.

.2 Notes:

.1 Install in upright position in horizontal run of pipe.

.2 Install a minimum of 5 pipe diameters downstream of any valves, elbows, orifices or any other obstructions.

.3 Adhere to manufacturer's installation recommendations.

2.9 SOLID STATE RELAYS (SSR)

.1 General:

.1 Relays to be socket or rail mounted.

.2 Relays to have LED Indicator

.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.

.4 Operating temperature range to be -20 degrees C to 70 degrees C.

.5 Relays to be CSA Certified.

.6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.

.7 Operational frequency range, 45 to 65 HZ.

.2 Input:

.1 Control voltage, 3 to 32 VDC.

.2 Drop out voltage, 1.2 VDC.

.3 Maximum input current to match AO (Analog Output) board.

.3 Output.

.1 AC or DC Output Model to suit application.

2.10 TEMPERATURE SENSORS

.1 General: Temperature sensors shall be thermistor, resistance or thermocouple type, however, thermocouples shall be restricted to temperature range +200°C and above.

.2 The following shall apply to thermistor, resistance or thermocouple temperature sensors as applicable.

.1 RTDs shall be 100 ohm or 1,000 ohm at 0^0C (+/- 0.2 ohm) nickel or platinum element with strain minimizing construction and 3 integral anchored leadwires coefficient of resistivity of 0.000385 ohms/ohm/ deg.C. Thermistors shall be 3,000 or 10,000 ohms.

.2 Sensing element to be hermetically sealed.

.3 Stem and tip construction to be copper or 304 stainless steel as noted.

.4 Sensors to have a time constant response of less than 3 seconds to a temperature change of 10°C.

.5 Sensors shall operate over the following ranges with the accuracies over the noted range of the sensor.

.1 -50°C to +50°C, plus or minus 0.5°C.

.2 0°C to +50°C, plus or minus 0.25°C.

.3 0°C to 25°C, plus or minus 0.1°C.

.4 0°C to 100°C, plus or minus 1°C.

.6 Immersion wells shall be of stainless steel materials for steam and domestic hot water and brass for other applications. Heat transfer compound to be compatible with sensor.

.7 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.

.8 Stability 0.02 degrees C drift per year.

.9 Separate mounting base for ease of installation.

.3 Temperature sensors shall be of the following types:

.1 Room type (RTS) - suitable for wall mounting, with or without protective guard. Element length of 10-50 mm with ceramic tube or equivalent mode of mechanical protection. Sensor shall have a set-point adjustment and occupancy override. Combination Room temperature sensor with temperature setpoint adjustment and occupancy override are acceptable

.2 General purpose duct type (DTS) - suitable for insertion into air ducts at any angle, insertion length shall be suitable for application. Copper sheathed construction.

.3 Spring-loaded thermowell type (ITS) - spring loaded construction with compression fitting for 20 mm NPT well mounting. Lengths shall be suitable for application. Stainless steel sheathed construction.

.4 Outside air type (OTS) - complete with non-corroding shield designed to minimize solar and wind effects, threaded fitting for mating to 12 mm conduit, probe length of 100 - 150 mm.

2.11 TEMPERATURE TRANSMITTERS (TTR)

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.

.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.

.3 Output signal: 4 - 20 mA into 500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.

.7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50 degrees C.

.10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.

.11 Transmitter ranges: select narrowest range to suit application from following:

.1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.

.2 0 to 100 degrees C, plus or minus 0.5 degrees C.

.3 0 to 50 degrees C, plus or minus 0.25 degrees C.

.4 0 to 25 degrees C, plus or minus 0.1 degrees C.

.5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.12 WIRING

.1 Wiring must be continuous without joints.

.2 Sizes:

.1 Field wiring to digital device: #18AWG minimum.

.2 Analog input and output: shielded #18 minimum solid copper.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Avoid mounting on outside wall; where unavoidable, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.5 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

.6 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.7 Fire stopping: provide space for fire stopping in accordance with, and provided under Section 07 84 00 – Fire Stopping. Maintain fire rating integrity.

.8 All field devices to be properly identified.

.9 Mount electrical instruments on standard electrical rough-in boxes fastened to structure.

.10 Provide a key for each instrument requiring a removable key up to a maximum of six. Obtain two signed receipts from the DCC Representative certifying that the keys have been received. Hand one over to the DCC Representative.

.11 Electrical:

- .1 Complete installation in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
- .3 Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by the DCC Representative before beginning Work.
- .4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .5 Install communication wiring in conduit.
  - .1 Provide complete conduit system to link Building Controllers and field panels.
  - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
  - .3 Maximum conduit fill not to exceed 40%.
  - .4 Design drawings do not show conduit layout.

.6 All wiring for the project must be in conduit.

3.2 TEMPERATURE SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:

.1 Protect from solar radiation and wind effects by non-corroding shields.

.2 Install in NEMA 4 enclosures.

.4 Duct installations:

.1 Do not mount in dead air space.

.2 Locate within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

.2 Wire multiple sensors in series for low temperature protection applications.

.3 Wire multiple sensors separately for temperature measurement.

.4 Use software averaging algorithm to derive overall average for control purposes.

.6 Thermowells: install for piping installations.

.1 Locate well in elbow where pipe diameter is less than well insertion length.

.2 Thermowell to restrict flow by less than 30%.

.3 Use thermal conducting paste inside wells.

.7 All sensors shall be stabilized to such a level as to permit on-the-job installations that will require minimum field adjustments or calibration.

.8 Sensor assemblies shall be readily accessible and adaptable to each type of application in such a manner as to allow for quick, easy replacement and servicing without special tools or skills.

.9 Install space instruments at a height of 1.5 m above the finished floor, unless otherwise indicated.

.10 Locate instruments in the same vertical centreline as light switches.

.11 Where instruments are indicated on an outside wall install on a stand-off wall bracket which provides an air space between the instrument and the wall; or on an insulating Base (e.g. a cork pad).

.12 Install protective metal guards on instruments in areas where they may be subject to damage (loading areas, workshops, public corridors and storage areas). Bolt guards, independent of instruments to separate baseplates. Provide backing in wall for securing mounting bases.

.13 Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only, and shall not be located in dead air spaces. The location shall be within the vibration and velocity limits of the sensor. Where an extended surface element is required to properly sense the average temperature it shall be securely mounted within the duct to measure the best average temperatures. Elements shall be thermally isolated from brackets and supports to respond to air temperature only. Sensor element to be supported separately and not connected to coils or filter racks.

.14 Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to affect proper flow across the entire area of the well. Well shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area.

3.3 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 TESTING AND COMMISSIONING

.1 Refer to Section 01 91 00 – Commissioning.

.2 All field devices shall be properly calibrated and tested for performance and accuracy. A report detailing test performed and results to be submitted to the DCC Representative for approval. The DCC Representative will verify results at random. Provide all testing equipment necessary. Provide manpower necessary to assist DCC Representative's verification.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings

1.2 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

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

.3 Shop drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.4 If changes are required, notify DCC Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to DCC Representative.

.5 Manufacturer's Field Reports: submit to DCC Representative manufacturer's written report, within 3 days of review, verifying compliance of Work as described in PART 3 - FIELD 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 incorporation into manual.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 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 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and inspection authorities.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

.3

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 Consultant via shop drawing submittal 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.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered and 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

2.8 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
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other	Green	Blue

Communication Systems

Fire Alarm	Red	
Emergency	Red	Blue
Voice		
Other	Red	Yellow
Security		
Systems		
HVAC controls	White	

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of DCC Representative.

.2 Inform DCC Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 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

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 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 1000 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.

3.7 SYSTEM STARTUP

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 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.

3.8 CLEANING

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors 0-1000 V.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-21, Canadian Electrical Code (CEC) Part I, 25th Edition, Safety Standard for Electrical Installations. Include amendments as adopted by the Province of Ontario and respective electrical safety bulletins issued by the Electrical Safety Authority.

.2 C22.2 No.18.3-12 (R2017), Conduit, Tubing, and Cable Fittings.

.3 C22.2 No.18.4-04 (R2013), Hardware for the Support of Conduit, Tubing, and Cable Positioning Devices.

.4 C22.2 No.65-13 (R2018), Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 00 - Cleaning.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 or NEMA to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, as required to: CSA-C22.2 No.18.3 and No.18.4.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors 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 CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.2 FIELD QUALITY CONTROL

.1 Check hand twist connectors for correct size and install tightly on conductors.

.2 Do not install stranded conductors under screw terminals unless compression lugs area installed.

.3 Install compression connectors using methods and tools recommended by manufacturer

.4 Check the following items:

.1 For branch circuit wiring #10 AWG and smaller, spliced together with spring type pressure wire connectors.

.2 Confirm the connectors are plier tightened.

.3 For joints in all other wiring, confirm colour keyed compression type connector has been utilized.

.4 Confirm no feeders have any form of a splice throughout its run.

.5 Confirm all connections are electrically and mechanically secured.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the requirements of the supply and installation of wires and cables for the complete electrical installation.

1.2 RELATED SECTIONS

.1 Section 26 05 34 - Conduit, Conduit Fastenings and Conduit Fittings

1.3 REFERENCES

.1 CSA C22.1 21, Canadian Electrical Code (CEC) Part I, 25th Edition, Safety Standard for Electrical Installations. Include amendments as adopted by the Province of Ontario and respective electrical safety bulletins issued by the Electrical Safety Authority.

.2 CSA-C22.2 No.0.3-01 (R2005), Test Methods for Electrical Wires and Cables.

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 00 – Cleaning.

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,

.1 208/120V system: use 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90XLPE for indoor use and RWU90XLPE for underground and outdoor use.

.3 Submittals not required.

2.2 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of cotton braid, thermoplastic jacket, and armour of closely wound aluminum wire.

.2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TWH polyethylene insulation with shielding of tape coated with paramagnetic material, wire braid metallized tapes over each conductor pair and overall covering of polyethylene jackets interlocked armour of aluminum strip.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section [26 05 00 - Common Work Results for Electrical

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduit, Conduit Fastenings and Conduit Fittings.

.2 Use VFD cable specifically for VFD installation.

3.4 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit systems in accordance with Section 26 05 34 – Conduit, Conduit Fastenings and Conduit Fittings.

.2 Ground control cable shield.

3.5 FIELD QUALITY CONTROL

.1 Ensure that wire and cable types used are as specified.

.2 Ensure that no conductor is undersize.

.3 Ensure all cables are installed in conduit.

.4 Ensure all cables are properly identified as per specifications.

.5 Check each conductor to confirm conductor do not have unintentional grounds.

.6 Ensure all cables are properly tightened as per Manufacturer’s recommendations.

.7 Check and confirm conduit fill not exceeding 40% for all branch circuit installation.

.8 Perform installation resistance testing:

.1 Meggar circuits, feeders and equipment up to 350V with a 500V instrument

.2 Meggar 350V-600V circuit, feeders and equipment with 1000V instrument.

.3 Check resistance to ground before energizing.

.9 Replace conductors as required.

.10 Submit results to the DCC Representative for record.

.11 Check circuit identification is being provided.

.12 Test each circuit for voltage drop and confirm voltage drop do not exceed Canadian Electrical Code requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation of hangers and supports for electrical systems

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 00 – Cleaning.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-21, Canadian Electrical Code (CEC) Part I, 25th Edition, Safety Standard for Electrical Installations. Include amendments as adopted by the Province of Ontario and respective electrical safety bulletins issued by the Electrical Safety Authority.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron or steel straps to secure surface conduits and cables 53 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 53 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diam. threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diam. threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of DCC Representative.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for junction boxes, pull boxes and cabinets

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results for Electrical

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 00 - Cleaning.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.2 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Not limited to these type of cabinets.

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.

.3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part1 General

1.1 SECTION INCLUDES

.1 Materials and installation for outlet boxes, conduit boxes and fittings

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 C22.1-21, Canadian Electrical Code (CEC) Part I, 25th Edition, Safety Standard for Electrical Installations. Include amendments as adopted by the Province of Ontario and respective electrical safety bulletins issued by Ontario Electrical Safety Code.

.2 C22.2 No.18.1-13 (R2018), Metallic Outlet Boxes.

.3 C22.2 No.18.2-06(R2021),Nonmetallic Outlet Boxes.

.4 C22.2 No.18.3-12 (R2021), Conduit, Tubing, and Cable Fittings.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 00- Cleaning.

Part2 Products

2.1 OUTLET AND CONDUIT BOXES - GENERAL

.1 Size boxes in accordance with CSA-C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED SHEET STEEL OUTLET BOXES

.1 One-piece electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76x50x38 mm or as indicated.102mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 CONDUIT BOXES

.1 Cast FS or feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.

.4 Double lock nuts and insulated bushings on sheet metal boxes.

2.5 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2-piece die-cast aluminum with brushed aluminum housing finish for two duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12x102 mm extension piece as indicated.

Part3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the requirements of supply and installation of conduits, conduit fastenings and conduit fittings for the electrical installation

.2 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only. Field coordination is necessary to avoid conflict with other service installations. Split up conduit racking if required by DCC Representative in order to alleviate loading imposed on structural members

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-21, Canadian Electrical Code (CEC) Part I, 25th Edition, Safety Standard for Electrical Installations. Include amendments as adopted by the Province of Ontario and respective electrical safety bulletins issued Ontario Electric Safety Code.

.2 CSA-C22.2 No. 18.1-13 (R2018), Metallic Outlet Boxes.

.3 CSA-C22.2 No. 18.2-06 (R2021), Nonmetallic Outlet Boxes.

.4 CSA-C22.2 No. 18.3-13 (R2018), Conduit, Tubing, and Cable Fittings.

.5 CSA-C22.2 No. 45.1-07 (R2017), Electrical Rigid Metal Conduit - Steel.

.6 CSA-C22.2 No. 56-17 (R2017), Flexible Metal Conduit and Liquid-tight Flexible Metal Conduit.

.7 CSA-C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing.

.8 CSA-C22.2 No. 211.2:06 (R2021), Rigid PVC (Unplasticized) Conduit.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA-C22.2 No. 45.1, galvanized steel, threaded.

.2 Electrical metallic tubing (EMT): to CSA-C22.2 No. 83, with couplings.

.3 Rigid Schedule 40 PVC conduit: to CSA-C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA-C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole malleable iron straps to secure surface conduits 53 mm and smaller.

.2 Two hole steel straps for conduits larger than 53 mm.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits at 1.5 m on centre.

.5 Threaded rods, 6 mm diameter, to support suspended channels.

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 degrees bends for 27 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 100 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 1/8” polypropylene string for conduit and ¼” nylon rope for underground duct.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use rigid galvanized steel threaded conduit where indicated and where required by Code.

.4 Use electrical metallic tubing (EMT) throughout except in cast concrete, where subject to mechanical injury or otherwise indicated.

.5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures, work in movable metal partitions or furniture systems.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Raceway installed on roof shall be supported on sleeper.

.8 All electrical roof penetration shall be installed and sealed in accordance with CRCA and OIRCA standards.

.9 All conduit shall be minimum of 21 mm diameter.

.10 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 21 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.15 Dry conduits out before installing wire.

.16 All rigid steel threaded conduit connected to boxes, panelboard and cabinet shall be terminated with a threaded hub type connector.

.17 Color code all exposed conduit to match the existing installation and building standards.

.18 Ground Wires:

.1 Provide bonding wire for each feeder or branch circuit wiring sized to CSA-C22.1 Table 16.

.2 Minimum ground wire size shall be #12 AWG for power wiring, #14 AWG for class 2 wiring.

.19 Conduits shall be grouped on Channels and follow building lines. All support channels shall be hot dipped galvanized rigid steel, with cut ends coated to prevent corrosion.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs on walls.

.3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.4 Run conduits in flanged portion of structural steel.

.5 Group conduits wherever possible on suspended or surface channels.

.6 Do not pass conduits through structural members except as indicated.

.7 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 horizontal runs in dry walls.

.4 Do not install conduits in concrete toppings.

3.5 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers, circuit breakers, ground-fault circuit-interrupters, and accessory high-fault protectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1 21, Canadian Electrical Code (CEC) Part I, 25th Edition, Safety Standard for Electrical Installations. Include amendments as adopted by the Province of Ontario and respective electrical safety bulletins issued by the Electrical Safety Authority.

.2 CSA-C22.2 No. 5-13, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures

1.3 SUBMITTALS

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

.2 Include time-current characteristic curves for breakers with ampacity of 225 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 – Cleaning.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, circuit breakers, ground-fault circuit-interrupters, and accessory high-fault protectors: to CSA-C22.2 No.5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breaker interrupting capacity rating to match existing breakers unless otherwise noted.

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.

2.3 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase fault short circuit protection.

.2 Provide solid state trip units for circuit breakers with 400A rated frames and above and where indicated on the drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Calibrate breakers in accordance with coordination study report.

END OF SECTION

Part 1 General

1.1 SECTION TO INCLUDE

.1 Materials and installation for motor starters

.2 Coordinate with Division 25 for EMCS interface and connections

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 NO. 14-13, Industrial Control Equipment.

.2 CSA C22.1 21, Canadian Electrical Code (CEC) Part I, 25th Edition, Safety Standard for Electrical Installations. Include amendments as adopted by the Province of Ontario and respective electrical safety bulletins issued by the Electrical Safety Authority.

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include operation and maintenance data for each type and style of starter.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 00 - Cleaning.

Part 2 Products

2.1 MATERIALS

.1 Starters: to CSA-C22.2 NO. 14.

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Selector switches: heavy duty labelled as indicated.

.2 Indicating lights: heavy duty type, minimum RED indicator light indicating on/running.

.3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

2.3 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses installed.

.3 Confirm motor nameplate and adjust overload device to suit.

.4 Coordinate with mechanical contractor (Division 23 and Division 25) for all control wiring requirements, the manufacturer shall provide start up service by a factory trained

service technician. The technician shall verify correct installation, start up the starter, and check for proper operation.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Provide a start-up and commissioning report which documents the procedures used and confirm the correct operation of the equipment at various system capacities. Report the voltage and amperage draw of each motor being controlled at three intermediate points and compare with expected values at those capacities.

.6 Provide complete check out to ensure all protective equipment to ensure reliable operation of drive and motor has been installed and wired correctly.

END OF SECTION