Part 1 General

1.1 GENERAL

.1 Submit to Contract Administrator submittals required by individual Specification sections for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract and no claim for extension by reason of such default will be allowed.

.2 In general, all equipment to be installed at the Site will require Shop Drawings, which shall be submitted to the Contract Administrator.

.3 Do not proceed with Work affected by submittal until reviewed by the Contract Administrator.

.4 The review by the Contract Administrator is for the sole purpose of ascertaining conformance with general concept. It does not provide 'approval' of the detail design inherent in shop drawings (which remains with the contractor), nor does it relieve the contractor of responsibility for errors or omissions in shop drawings or for meeting all requirements of the construction and contract documents

.5 Present submittals in SI Metric units.

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

.7 Review submittals prior to submission to Contract Administrator. 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.

.8 Notify Contract Administrator, in writing at time of submission for review, identifying deviations from requirements of Contract stating reasons for deviations.

.9 Verify field measurements and affected adjacent Work are co-ordinated.

.10 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator’s review of submittals.

.11 Contractor's responsibility for deviations in submission from requirements of Contract is not relieved by Contract Administrator review.

.12 The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of submittals. The Contractor shall direct specific attention in writing or on resubmitted submittals to revisions other than the corrections requested by the Contract Administrator on previous submission.

.13 After Contract Administrator’s review and return of copies, distribute copies to sub-trades as appropriate.

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

1.2 SUBMITTAL PROCEDURES

.1 Direct submittals to the Contract Administrator.

.2 Hardcopy Submittals: Submit hardcopies only where specifically required under individual Specifications sections.

.3 Electronic Submittals: Submittals made in electronic format shall be as follows:

.1 Each submittal shall be electronic file in Adobe Acrobat Portable Document Format (PDF), and native files (e.g. Word, Excel, AutoCAD, etc.). Use 2010 version available at time of execution of Agreement.

.2 Electronic files that contain more than 10 pages in PDF format shall contain internal book marking from index page to major sections of document.

.3 PDF files shall be set to open "Bookmarks and Page" view.

.4 Add general information to each PDF file, including title, subject, author, and keywords.

.5 PDF files shall be set up to print legibly at 8.5 inches by 11 inches, or 11 inches by 17 inches, or 22 inches by 34 inches. No other paper sizes will be accepted.

.6 Submit new electronic files for each resubmittal.

.7 Include copy of Transmittal of Contractor's Submittal. .

.8 Contract Administrator will reject submittals that are not accompanied by an electronic copy.

.9 Provide authorization for Contract Administrator to reproduce and distribute each file as many times as necessary for Project documentation.

.10 Detailed procedures for handling electronic submittals will be discussed at pre-construction meeting.

.4 Schedule of Submittals

.1 Prepare a table listing all anticipated submittals required to complete the Work.

.2 For each Specification section show, at a minimum, the following:

.1 Specification section.

.2 Total number of submittals for each specification section.

.3 Identify each submittal by its submittal number in accordance with a numbering and tracking system.

.4 Identify each submittal by its name or title.

.5 Identify the estimated date of submission to the Contract Administrator.

.6 State the revision number and status for each submittal.

.3 On a monthly basis, submit an updated schedule of submittals to the Contract Administrator if changes have occurred.

.5 Transmittal of Submittal:

.1 Stamp each submittal with uniform approval stamp before submitting to Contract Administrator.

.1 Stamp to include project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with Contract.

.2 Contract Administrator will not review submittals that do not bear Contractor's approval stamp and will return them without action.

.3 Contract Administrator will not review submittals received directly from a Subcontractor and will return them without action.

.4 Complete, sign, and transmit with each submittal package, one transmittal of Contractor's submittal form.

.2 Identify each submittal with the following:

.1 Numbering and tracking system:

.1 Sequentially number each submittal.

.2 Resubmission of submittal shall have original number with sequential alphabetic suffix.

.2 Specification section and paragraph to which submittal applies.

.3 Project title and City Tender number.

.4 Date of transmittal.

.5 Name of Contractor.

.3 Identify and describe each deviation or variation from Contract.

.4 Include Contractor's written response to each of Contract Administrator's review comments with resubmission of submittals stamped "Exceptions Noted, Resubmit".

.6 Format:

.1 Do not base Shop Drawings on reproductions of Contract documents.

.2 Package submittal information by individual Specification section. Do not combine different Specification sections together in submittal package, unless otherwise directed in Specification.

.3 Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract.

.4 Index with labeled tab dividers in orderly manner.

.7 Timeliness:

.1 Schedule and submit in accordance with schedule of submittals, and requirements of individual Specification sections.

.2 Submit Shop Drawings and samples well in advance of scheduled delivery date for associated equipment or material and in an orderly sequence so as to cause no delay in the Work.

.8 Processing Time:

.1 Time for review shall commence on Contract Administrator's receipt of submittal.

.2 Contract Administrator will act upon Contractor's submittal and transmit response to Contractor not later than 14 Calendar Days after receipt, unless otherwise specified.

.3 Resubmittals will be subject to same review time.

.4 The review time required will not alleviate the Contractor of his responsibility to deliver the completed Work within the required time frame and schedule. Planning for submittal reviews and the risk to the construction schedule remains the Contractor's sole responsibility.

.9 Resubmittals:

.1 Clearly identify each correction or change made and include revision date.

.2 No adjustment of the schedule outlined in the Supplemental Conditions or Contract Price will be allowed due to delays in progress of Work caused by rejection and subsequent resubmittals.

.3 The City may deduct cost of additional reviews from the Contract Price.

.10 Incomplete Submittals:

.1 The Contract Administrator will return the entire submittal for the Contractor's revision if preliminary review deems it incomplete.

.2 Incomplete Shop Drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.

.3 When any of the following are missing, the submittal will be deemed incomplete:

.1 Contractor's review stamp, completed and signed.

.2 Transmittal of Contractor's Submittal form, completed and signed.

.3 Insufficient number of copies.

.4 All requested information is not provided.

.5 Submittals missing professional engineer's seal and signature, where it is required.

.11 Submittals not required by Contract:

.1 Will not be reviewed and will be returned stamped "RECEIVED FOR INFORMATION".

.2 Contract Administrator will keep one copy and return all remaining copies to Contractor.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "Shop Drawing" as defined in the City's General Conditions for Construction (Revision 2019-09-01) means all drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor, Subcontractor, manufacturer, supplier or distributor and which illustrate some portion of the Work.

.2 Shop Drawings are to indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Drawings and Specifications.

.3 Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

.4 Notify the Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract.

.5 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in the province of Manitoba as required in the Specifications. The following components require sealed Shop Drawings:

.1 Reinforcing Steel
.2 Metal Fabrications
.3 Stem Extensions
.4 Automation PLC and control panels

.6 The Contractor shall examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract. Examination of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person of the Subcontractor for supplied items and of the Contractor for fabricated items. Shop Drawings not stamped, signed and dated will be returned without being reviewed and stamped " REVISE AND RESUBMIT ". Ensure that the following are verified:

.1 Field measurements.
.2 Field construction criteria.
.3 Catalogue numbers and similar data.

.7 Submittals shall be in one of the following formats:

.1 Submit three (3) copies of white prints and three (3) copies of all fixture cuts and brochures.
.2 Submit one electronic PDF copy.

.8 Shop Drawings will be returned to the Contractor with one of the following notations:

.1 When stamped "REVIEWED" or "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.
.2 When stamped "REVIEWED AS MODIFIED" or "MAKE NOTED CORRECTIONS", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".

.3 When stamped "REVISE AND RESUBMIT", make the necessary revisions, as indicated, consistent with the Contract and submit again for review.

.4 When stamped "NOT REVIEWED" or "REJECTED", submit other Shop Drawings, brochures, etc., for review consistent with the Contract.

.5 Only Shop Drawings bearing "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS", or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.

.9 After submittals are stamped "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.

.10 Make changes in Shop Drawings, which the Contract Administrator may require, consistent with Contract. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

.11 Only two reviews of Shop Drawings will be made by the Contract Administrator at no cost. Each additional review will be charged to the Contractor at the Contract Administrator's scheduled rates. The Contract Administrator's charges for the additional Work will be deducted from the payment to the Contractor.

1.4 DESCRIPTION OF CONSTRUCTION METHODS

.1 The Contractor shall, if required by the Contract Administrator, submit for the review of the Contract Administrator method statements which describe in detail, supplement with Drawings where necessary, the methods to be adopted for executing any portion of Work.

.2 These statements shall also include details of constructional Plant and labour to be employed. Acceptance by the Contract Administrator shall not relieve the Contractor of any of his responsibilities, nor shall reasonable refusal to approve entitle the Contractor to extra payment or an extension of time.

.3 Other Considerations

.1 Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent Shop Drawings and resubmit.

1.5 REQUESTS FOR INFORMATION

.1 In the event that the Contractor or any Subcontractor involved in the Work, determines that some portion of the Drawings, Specifications, or other Contract documents requires clarification or interpretation by the Contract Administrator, the Contractor shall submit a Request for Information (RFI) in writing to the Contract Administrator.

.2 Submission Procedure

.1 Submit RFI's to the Contract Administrator on the "Request for Information" form appended to this section. The Contract Administrator shall not respond to a RFI except as submitted on this form.

.2 Number RFI's consecutively in one sequence in order submitted, in a numbering system established by the Contract Administrator.

.3 Submit one distinct subject per RFI request. Do not combine unrelated items on one form.

.4 Where RFI form does not have sufficient space, attach additional sheets as required.

.5 Submit with RFI form all necessary supporting documentation.

.3 In the RFI, the Contractor shall clearly and concisely set forth:

.1 the issue for which clarification or interpretation is sought and why a response is needed from the Contract Administrator; and

.2 an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

.4 The Contract Administrator will review all RFIs to determine whether they are valid RFIs. If it is determined that the document is not a valid RFI, it will be returned to the Contractor not having been reviewed with an explanation why it was deemed not valid.

.5 A RFI response shall be issued within 14 Calendar Days of receipt of the request from the Contractor unless the Contract Administrator determines that a longer time is necessary to provide an adequate response. When the RFI submission is received by the Contract Administrator before noon, the review period commences on that Calendar Day. When the RFI submission is received by the Contract Administrator after noon, the review period commences on the subsequent Calendar Day.

.6 If, at any time, the Contractor submits a large number of RFI's or the Contract Administrator considers the RFI to be of such complexity that the Contract Administrator cannot process the RFI's within 14 Calendar Days, the Contract Administrator, shall confer with the Contractor within five Calendar Days of receipt of such RFI's, and the Contract Administrator and the Contractor will jointly prepare an estimate of the time necessary for processing same as well as an order of priority among the RFI's submitted. The Contractor shall accommodate such necessary time at no impact to the schedule and at no additional cost to the Contract.

.7 If the Contractor submits a RFI on an activity with 14 Calendar Days or less of available time to the impacted activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Contractor Administrator to respond to the request provided that the Contract Administrator responds within the 14 Calendar Days set forth above.

.8 A RFI response from the Contract Administrator will not change any requirement of the Contract. In the event the Contractor believes that the RFI response from the Contract Administrator will cause a change to the requirements of the Contract, the Contractor shall within 14 Calendar Days give written notice to the Contract Administrator stating that the Contractor believes the RFI response will result in a change in requirements to the Contract and the Contractor intends to submit a change request. Failure to give such written notice of 14 Calendar Days shall waive the Contractor's right to seek additional time or cost under the requirements of the Contract.

1.6 CLOSEOUT SUBMITTALS

.1 Refer to Section 1 78 00 - Closeout Submittals for closeout submittal requirements.

1.7 MISCELLANEOUS SUBMITTALS

.1 Prepare and submit submittals required by individual Specification sections of the Contract Documents.

.2 Copies: Submit one electronic copy to Contract Administrator. Method of electronic submission to be coordinated with Contract Administrator after execution of the Contract. Submit hard copies only where specifically required under individual Specification sections.

.3 Contract Administrator will review submittals for general conformance with design concept and intent, and general compliance with Contract.

.4 Contract Administrator's review does not relieve Contractor from compliance with requirements of Contract nor from errors in submittals or Contractor's design.

.5 Contractor is responsible for confirmation of dimensions at jobsite; fabrication processes; means, methods, techniques, sequences and procedures of construction; coordination of work of all trades; and performance of Work in safe and satisfactory manner.

.6 At Contract Administrator's option, Contract Administrator's review comments and review stamp will be placed either directly on submitted copies of submittals or on separate submittal review comment form.

.7 Where work is to be designed by Contractor, comply with applicable codes and furnish submittals signed and sealed by professional engineer licensed in Province of Manitoba, as required by Specifications. If requested, calculations shall be submitted for review. Calculations shall also be signed and sealed by a professional engineer registered in the Province of Manitoba.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 41 00.08 – Demolition – Minor Works.

.2 Section 02 82 00 – Asbestos Abatement – Intermediate.

1.2 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.3 REFERENCE STANDARDS

.1 Canadian Society of Landscape Architects (CSLA) / Canadian Nursery Landscape Association (CNLA)

.1 Canadian Landscape Standard 2016, First Edition

.2 Canadian Nursery Stock Standard 2017, Ninth Edition

.2 United States Environmental Protection Agency (EPA), Office of Water

.1 EPA-833-R-06-004, Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites

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 hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two WHMIS Safety Data Sheets (SDS) to Contract Administrator for any environmental or health and safety hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Contract Administrator that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.4 Hazardous waste classification: identify waste codes applicable to each hazardous waste material based on applicable federal and provincial acts, regulations, and guidelines. Waste profiles, analyses, and classification submitted to contract offices for review and approval.

.5 Asbestos materials shall be handled as outlined under Section 02 82 00 – Asbestos Abatement – Intermediate.

.3 Submit Environmental Protection Plan (EPP) for review by City Departmental Representative before delivering materials to site or commencing construction activities.

.4 EPP shall include comprehensive overview of known or potential environmental issues to be addressed on site during construction.

.5 Address topics at level of detail commensurate with environmental issue and required construction task [s].

.6 Include in Environmental Protection Plan (EPP):

.1 Name [s] of person [s] responsible for ensuring adherence to EPP.

.2 Name [s] and qualifications of person [s] responsible for manifesting hazardous waste to be removed from site.

.3 Name [s] and qualifications of person [s] responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Submit a Site Work Plan (SWP) showing work areas for proposed activities in each portion of area and identifying areas of limited use or non-use.

.1 SWP to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.6 Submit a Spill Control Plan (SCP) including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.7 Submit a Solid Waste Disposal Plan (SWDP) for non-hazardous solid wastes identifying methods and locations for solid waste disposal including clearing debris.

.8 Submit an Air Pollution Control Plan (APCP) detailing provisions to ensure that dust, debris, materials, and trash, are contained within the project site.

.9 Submit a site-specific Contaminant Prevention Plan (CPP) identifying the proper procedures and actions to be implemented to prevent potentially or expected hazardous substances due to the presence of any hazardous substances within the project site. The intent of the CPP is to:

.1 Prevent introduction of designated substances (DS) into air, water, or ground.

.2 Detail provisions for storage and handling of these materials in compliance with Federal, Provincial, and Municipal laws.

.10 Submit a Wastewater Management Plan (WMP) identifying methods and procedures for management and discharge of waste waters which are directly

derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.11 Submit an Identification and Protection Plan (IPP) that defines procedures for identifying and protecting historical, archaeological, cultural and biological resources and wetlands.

.12 Submit a Pesticide Treatment Plan (PTP) identifying the presence of any pesticides within the site. PTP to be updated as required.

1.5 FIRES

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

1.6 DRAINAGE

.1 Ensure that the ESCP measures are provided and that its recommendations are followed on site, in accordance with the site-specific SPPP, at all times during construction.

.2 Provide temporary drainage and pumping as required to keep excavations on site free of standing water.

.1 Obtain Contract Administrator approval before pumping standing water, which is free of suspended materials, into waterways, sewer or drainage systems.

.2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with the site-specific SPPP in compliance with the requirements of authorities having jurisdiction.

1.7 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties in accordance with the Canadian Landscape Standard -First Edition, Section 03 - Site Preparation and Protection of Existing Site Elements.

.2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of two (2) m minimum. Ensure that control measures used for protection are in compliance with Municipal laws and regulations.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Restrict tree removal to areas indicated or designated by Contract Administrator. Obtain permits before trees removal in accordance with the requirements of the authorities having jurisdiction.

1.8 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract in accordance with site-specific SPPP.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements. Check with local authorities for any environmental compliance requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

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

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 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.

.7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by City.

1.9 HISTORICAL/ ARCHAEOLOGICAL CONTROL

.1 Refer to the site-specific IPP for procedures in identifying and protecting historical and archaeological resources previously known to be on project site or discovered during construction.

.1 Plan to include methods to ensure protection of known or discovered resources and identify lines of communication between Contractor personnel and Contract Administrator.

1.10 NOTIFICATION

.1 Contract Administrator will notify Contractor in writing of observed noncompliance with Federal, Provincial environmental laws and regulations or Municipal environmental bylaws, permits, and other elements of site-specific plans, as applicable.

.2 Contractor after receipt of such notice, shall inform Contract Administrator of proposed corrective action and take such action to obtain the approval of Contract Administrator.

.1 Take action only after receipt of written approval by Contract Administrator.

.3 Contract Administrator will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted, or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Bury rubbish and waste materials on site is nor permitted unless approved in writing by Contract Administrator.

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

.4 Proceed with final cleaning upon completion and removal of surplus materials, rubbish, tools and equipment.

.5 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 General

1.1 SUBMITTALS

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

.2 Provide the following submittals where requested in individual Specification sections:

1. Qualifications of Contractor's Representative
2. Form 100: Certificate of Equipment Delivery
3. Form 102: Certificate of Satisfactory Installation
4. Functional test results (equipment test reports)
5. Form 103: Certificate of Equipment Satisfactory Performance
6. Performance test report
7. Form 104: Certificate of Satisfactory System Performance

1.2 QUALIFICATION OF CONTRACTOR'S REPRESENTATIVE

1. Authorized representative of the Contractor and experienced in the installation and maintenance of respective equipment, subsystem, or system.

2. Representative subject to acceptance by the Contract Administrator. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 Products

2.1 NOT USED

PART 3 Execution

3.1 EQUIPMENT DELIVERY

1. The Contractor shall be responsible for receiving, off-loading, and placing into storage all equipment at the Site. Certificate of Equipment Delivery (Form 100), a copy of which is attached to this section, shall be completed.

3.2 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

1. Furnish Contractor's services when required by an individual Specification section, to meet the requirements of this section.

2. Where time is necessary in excess of that stated in the Specifications for Contractor's services, or when a minimum time is not specified, the time required to perform the specified services shall be considered incidental.

3. Schedule Contractor's services to avoid conflict with other onsite testing or other Contractor's onsite services.

4. Determine, before scheduling services, that all conditions necessary to allow successful testing have been met.

5. Only those days of service approved by the Contract Administrator will be credited to fulfill the specified minimum services.

6. When specified in individual Specification sections, Contractor's onsite services shall include:
    1. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer.
    2. Revisiting the Site as required to correct problems and until installation and operation are acceptable to the Contract Administrator.
    3. Resolution of assembly or installation problems attributable to, or associated with, respective installed products and systems.
    4. Assistance during functional and performance testing, and facility startup and evaluation.
    5. Additional requirements may be specified elsewhere.

3.3 EQUIPMENT INSTALLATION

1. After installation is complete, the Contractor's representative shall verify successful installation.

2. The Contractor's representative shall conduct a detailed inspection of the installation including alignment, mechanical connections, piping, lubrication, workmanship, and all other items as required to ensure successful operation of the equipment.

3. The Contractor's representative shall identify any outstanding deficiencies in the installation.

4. The deficiencies shall be rectified by the installation Contractor and the Contractor's representative shall re-inspect the installation.

5. When the Contractor's representative accepts the installation, Certificate of Satisfactory Installation (Form 102), attached to this Specification, shall be signed by the Contractor's representative, the Contract Administrator, and the City.

6. Deliver the completed Form 102 to the Contract Administrator prior to departure of the tradespersons from the Site.

7. Tag the equipment with a 100 mm x 200 mm card stating "EQUIPMENT CHECKED. DO NOT RUN." stenciled in large black letters. Sign and date each card.

8. Separate copies of Form 102 shall be furnished for each individual unit process item of equipment. In addition, furnish a copy of Form 102 for the entire system supplied under this Contract.

3.4 EQUIPMENT PERFORMANCE TESTING (FUNCTIONAL TESTING)

1. After the installation has been verified and any identified deficiencies have been remedied, the equipment shall be subjected to functional testing. Ready-to-test determination will be by the Contract Administrator based at least on the following:
    1. Adequate completion of Work adjacent to, or interfacing with, equipment to be tested, including items to be furnished by others.
    2. Equipment and electrical tagging complete.
    3. Availability and acceptability of Contractor's representative to assist in testing of respective equipment.
    4. Receipt of:
        a. Certificate of Equipment Delivery (Form 100)
        b. Certificate of Satisfactory Installation (Form 102)
    5. Final operation and maintenance manuals.
    6. Notification by Contractor's representative of equipment readiness for testing.

2. The Contractor's representative shall conduct all necessary checks to equipment and, if necessary, conduct further flushing, cleaning, or other remedial measures required to ensure satisfactory operation prior to confirming the equipment is ready to run.

3. The Contractor's representative shall then notify the Contract Administrator of their readiness to demonstrate the functional operation of the equipment. The Contract Administrator shall attend, as expeditiously as possible.

4. The Contractor's representative shall demonstrate that the equipment is properly installed. Alignment, piping connections, electrical connections, rotations checked, etc., shall be checked and if appropriate, code certifications provided.

5. On satisfactory completion of the one (1) hour functional demonstration, the equipment shall be stopped and critical parameters and equipment systems shall be rechecked.

6. The equipment shall then be run continuously for at least one (1) day. During this period, as practicable, conditions shall be simulated which represent the full range of operating conditions. These conditions shall be mutually agreed by the Contractor and the Contract Administrator on the basis of the information contained in the Specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.

7. Should the functional testing reveal any defects, then those defects shall be promptly rectified and the functional tests shall be repeated to the satisfaction of the Contract Administrator. If the defects are attributed to the Contractor, additional costs to repeat functional tests shall be the responsibility of the Contractor. The City shall deduct such costs from the Contract, amount of which will be determined by the Contract Administrator.

8. Equipment Test Reports: Provide written test reports for each item of equipment tested, to include the minimum information:
    1. City/Project Name/Tender number.
    2. Equipment or item tested.
    3. Date and time of test.
    4. Type of test performed (Functional).
    5. Test conditions.
    6. Test results.
    7. Signature space for Contractor and Contract Administrator representatives.

9. On successful completion of the functional test, Certificate of Equipment Satisfactory Performance (Form 103) attached to this Specification shall be signed by the Contract's representative, the Contract Administrator, and the City.

10. When, in Contract Administrator's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase.

3.5 SYSTEM PERFORMANCE TESTING

1. Equipment shall be subjected to a performance test in accordance with the Specifications. Performance testing shall not commence until equipment has been accepted by the Contract Administrator as having satisfied the functional test requirements.

2. The Contractor shall submit the results of the performance tests to the Contract Administrator, documented and summarized in a format acceptable to the Contract Administrator. The Contract Administrator reserves the right to request additional testing. No equipment shall be accepted and handed over to the City prior to the satisfactory completion of the performance test(s) and receipt of the test reports.

3. Should the performance tests reveal any defects, then those defects shall be promptly rectified and the performance tests shall be repeated to the satisfaction of the Contract Administrator. If the defects are attributed to the Contractor, additional costs incurred due to repeat functional tests, and/or performance tests shall be the responsibility of the Contractor.

4. On successful completion of the performance tests, Certificate of Satisfactory System Performance (Form 104) attached to this Specification shall be signed by the Contractor's Representative, the Contract Administrator, and the City.

5. Total Performance shall only be issued after issuance of every required Form 104 and all other requirements of Total Performance have been met.

3.6 SUPPLEMENTS

1. The supplements listed below, following "End of Section", are part of this Specification.
    1. Forms:
        a. Form 100: Certificate of Equipment Delivery

b. Form 102: Certificate of Satisfactory Installation
c. Form 103: Certificate of Equipment Satisfactory Performance
d. Form 104: Certificate of Satisfactory System Performance

END OF SECTION

Water and Waste Department • Service des eaux et des déchets

Form 100
CERTIFICATE OF EQUIPMENT DELIVERY

1. We certify that the equipment listed below has been delivered into the care and custody of the installation Contractor. The equipment has been found to be in satisfactory condition. There is no visible evidence of exterior damage or defects.

Project:
Equipment Description:
Equipment Supply Bid Opp. No.: -2019
Equipment Install Bid Opp. No.: -2019
Equipment Tag No.:
Specification Reference:

Print Name	Signature	Date
(Authorized Representative of City)		

Print Name	Signature	Date
(Authorized Representative of Contractor)		

Print Name	Signature	Date
(Authorized Representative of Contract Administrator)		

Water and Waste Department • Service des eaux et des déchets

Form 102
CERTIFICATE OF SATISFACTORY INSTALLATION

We have completed our checks and inspection of the installation of our equipment as listed below and confirm that it is satisfactory and that any defects have been remedied except any as noted below.

Project:
Equipment Description:
Equipment Supply Bid Opp. No.: -2019
Equipment Install Bid Opp. No.: -2019
Equipment Tag No.:
Specification Reference:
Outstanding Defects:

Print Name	Signature	Date
(Authorized Representative of City)		

Print Name	Signature	Date
(Authorized Representative of Contractor)		

Print Name	Signature	Date
(Authorized Representative of Contract Administrator)		

Water and Waste Department • Service des eaux et des déchets

Form 103
CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE

We certify that the equipment listed below has been continuously operated for a minimum of one (1) day and that the equipment operates satisfactorily and meets it's specified operating criteria. No defects in the equipment were found and as such are classified as "conforming".

Project:
Equipment Description:
Equipment Supply Bid Opp. No.: -2019
Equipment Install Bid Opp. No.: -2019
Equipment Tag No.:
Specification Reference:

Print Name	Signature	Date
(Authorized Representative of City)		
Print Name	Signature	Date
(Authorized Representative of Contractor)		
Print Name	Signature	Date
(Authorized Representative of Contract Administrator)		

Water and Waste Department • Service des eaux et des déchets

Form 104
CERTIFICATE OF SATISFACTORY SYSTEM PERFORMANCE

We certify that the system listed below has been continuously operated and tested as per the Specifications and that the equipment meets its performance testing and operating criteria. No defects in the process system were found and as such are classified as "conforming".

Project:
Equipment Description:
Equipment Supply Bid Opp. No.: -2019
Equipment Install Bid Opp. No.: -2019
Equipment Tag No.:
Specification Reference:

Print Name	Signature	Date
(Authorized Representative of City)		

Print Name	Signature	Date
(Authorized Representative of Contractor)		

Print Name	Signature	Date
(Authorized Representative of Contract Administrator)		

Part 1 General

1.1 INSPECTION

.1 Allow Contract Administrator access to the Work. If part of the Work is in preparation at locations other than the Site, allow access to such Work wherever it is in progress.

.2 Give timely notice of a minimum of 5 working days, requesting inspection if the Work is designated for special tests, inspections or approvals by Contract Administrator.

.3 If the 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 at no additional cost and have inspections or tests satisfactorily completed and make good such Work.

.4 The Contract Administrator will order part of the Work to be examined if the Work is suspected to be not in accordance with Contract. If, upon examination, such work is found not in accordance with Contract, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract, the City shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent inspection/testing agencies may be engaged by the City for purpose of inspecting and/or testing portions of the Work. The cost of such services will be borne by the City. Costs of additional tests required due to defective Work shall be paid by the Contractor.

.2 All equipment required for executing inspection and testing will be provided by the respective agencies.

.3 Employment of inspection/testing agencies does not relieve or relax the Contractor's responsibility to perform the Work in accordance with the Contract.

.4 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain the full degree of defect. Correct the defect and irregularities as advised by the Contract Administrator at no cost to the City. The Contractor shall be responsible for the costs of the subsequent testing and inspection of the corrected Work. The City shall deduct such costs from the Contract, amount of which will be determined by the Contract Administrator.

1.3 ACCESS TO WORK

.1 The City, the Contract Administrator, and other authorities having jurisdiction shall have access to the Work. Do not cover or enclose systems prior to inspection.

1.4 REJECTED WORK

.1 Remove defective Work, whether the result of poor workmanship, use of defective products, or damage which has been rejected by the Contract Administrator as failing to conform to the Contract. Replace or re-execute in accordance with the Contract.

.2 Make good other Contractor's work damaged by such removals or replacement of defective Work.

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

1.5 REPORTS

.1 Submit draft inspection and test reports to the Contract Administrator, prior to inclusion with the operation and maintenance manuals.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls as required in order to execute Work expeditiously.

.2 Remove from Site all temporary utilities when their use is no longer required.

1.2 DEWATERING

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

1.3 WATER SUPPLY

.1 Provide potable water as required for construction use.

1.4 TEMPORARY HEATING, COOLING AND VENTILATION

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

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heating, cooling, and ventilation in enclosed areas as required to:

.1 Facilitate progress of the Work.

.2 Protect the 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. A minimum of 6 air changes per hour of continuous ventilation is required in below grade drywell areas.

.6 Maintain a minimum of 10°C in areas where construction is in progress. Maintain temperatures of minimum 10° C during heating season and maximum of 20° C during cooling season

.4 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.

.5 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.

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

1.5 TEMPORARY POWER AND LIGHT

.1 Provide temporary construction power as required to facilitate construction activities.

.2 Provide temporary power and light as required for temporary dewatering pumping, construction power, lighting, and other requirements during shutdowns.

.3 The existing power supply may be utilized for power, provided that there are no operational impacts associated with the use of the power.

.1 Connect to existing power supply in accordance with Canadian Electrical Code.

.2 Electrical power and lighting systems installed under this Contract may be used for construction requirements provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract.

.4 All temporary power generation shall have residential grade mufflers and silencers.

1.6 TEMPORARY COMMUNICATION FACILITIES

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

1.7 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of the Work required by insurance companies having jurisdiction and governing codes, regulations, and bylaws. If fire alarm systems are disabled, provide (and include all costs) for a full-time (24-hours per day) fire watch person.

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

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 Submittals

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

1.2 INSTALLATION AND REMOVAL

.1 Prepare and submit Site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area, and details of fence installation. In addition, show any proposed laydown areas, proposed location of crane use in order to ensure any large equipment is not being placed over critical water infrastructure.

.2 Indicate use of supplemental or other staging area.

.3 Provide construction facilities in order to execute the Work expeditiously.

.4 Remove from Site all such work after use.

1.3 SCAFFOLDING

.1 Scaffolding in accordance with:

.1 CAN/CSA-S269.2 - Access Scaffolding for Construction Purposes

.2 C.C.S.M.c W210 - Manitoba, The Workplace Safety and Health Act

.2 Provide and maintain scaffolding and ladders.

1.4 HOISTING

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

.2 Hoists to be operated by qualified operator.

1.5 CONSTRUCTION PARKING

.1 Parking will be permitted on Site provided it does not disrupt performance of Work or access by the City.

.1 Ensure that access and parking for a minimum of one truck is provided adjacent to the pumping station, for use by the City.

.2 Provide and maintain adequate access to project Site.

.3 Construction parking must not impede delivery access to the Chlorine Building/tonner rooms.

.4 At 360 McPhillips Street – where the McPhillips Regional Pumping Station, Chlorine Building, Collections Building and McPhillips Control Centre are located - Contractor parking can be accommodated on Hillock Avenue (a Use of Street Permit will be

required). Alternately the old reservoir cells (at the west end of Hillock Avenue) could be used for Contractor trailers etc. The Contractor shall be responsible for fence and access modifications to accommodate the use of the reservoir cells. Do not impact upon local businesses.

.5 At 875 Lagimodiere Blvd– where the Maclean Regional Pumping Station is located - Contractor parking can be accommodated south of the facility along the road to the Reservoir Valve House. Parking is permitted in front of the pumping station, but adequate parking shall be left for City of Winnipeg personnel who need to access the station.

.6 At 60 Hurst Way, where Hurst Pumping Station is located, Contractor parking can be accommodated at the front of the station. Adequate parking shall be left for City of Winnipeg personnel who need to access the station.

1.6 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.7 SANITARY FACILITIES

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

.2 In the event that the City allows the Contractor to use facility washrooms, the Contractor must clean the washrooms at the end of each work day.

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

1.8 OFFICES

.1 Contractor will not be allowed to use City facilities as their office. Contractor to provide alternate means for an office such as an on site trailer.

.2 Provide office heated to 20 degrees C, lighted, and ventilated, of sufficient size to accommodate Site meetings and furnished with drawing laydown table.

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

.4 Subcontractors to provide their own offices as necessary. Direct location of these offices.

.5 Supply temporary office facilities for the Contract Administrator on Site, meeting the following requirements:

.1 Minimum floor area of 20 square metres, with windows and a door entrance complete with suitable lock satisfactory to the Contract Administrator.

.2 Suitable for all-weather use and capable of maintaining a temperature range between 20 and 25 degrees C.

.3 Equipped with fluorescent lights and 120 volt ac electrical wall outlets

.4 Furnished with one desk, one filing cabinet, and two chairs, all satisfactory to the Contract Administrator.

.5 Provide four additional chairs available on site to facilitate scheduled site meetings between Contractor, Contract Administrator, and City Personnel.

.6 All of the temporary structures provided by the Contractor for this project shall be stabilized in a sufficient manner to prevent the temporary structure from being overturned by wind forces as defined in the National Building Code (NBC). The stabilization provided shall be designed by a Professional Engineer registered in the Province of Manitoba. Detailed drawings and design notes for the stabilization works bearing the Engineer's seal shall be provided to the Contract Administrator for review.

.7 The Contractor shall be responsible for installation, maintenance, removal, operating costs, and service installation costs for the field office as described herein.

1.9 LAYDOWN AND STORAGE

.1 All construction materials shall be stored at designated storage areas. Stored combustible materials shall be separated by clear space to prevent fire spread and allow access for manual fire fighting equipment, including fire hoses, extinguishers, hydrants, etc.

.2 Pressurized dry chemical fire extinguishers of suitable capacity or equally effective extinguishers as per NFPA 10 shall be provided where:

.1 Flammable liquids are stored or handled.

.2 Welding or flame cutting is performed.

1.10 DISPOSAL OF WASTE MATERIALS

.1 Spoiled and waste materials shall not be dumped, under any circumstances, in any locations other than those approved by the local authorities. Any cost for permits and fees for disposing of waste materials shall be at the Contractor's expense.

.2 Disposal of all excavated and waste materials shall be in accordance with the requirements of the appropriate provincial regulatory agencies.

.3 When working anywhere within the Works, the Contractor shall at the end of each day remove the rubbish and leave the Site in a clean and tidy state, to the satisfaction of the Contract Administrator. If this is not done, the City may clean the Site and deduct such costs from the Contract, amount of which will be determined by the Contract Administrator.

1.11 FACILITY ELECTRICAL SUPPLY AND DISTRIBUTION

.1 If service interruptions are necessary, such interruptions shall be made only at times approved by the Contract Administrator.

1.12 WARNINGS AND TRAFFIC SIGNS

.1 All Work affecting Site access must be authorized by the Contract Administrator. Provide a minimum of two weeks notice to the Contract Administrator when Work will affect Site access.

.2 When Work is performed within public areas, provide and erect adequate warning signs as necessary to give proper warning. Place signs sufficiently in advance to enable public to respond to directions.

.3 Provide and maintain signs and other devices required to indicate construction activities or other temporary or unusual conditions resulting from the Work.

Part 2 Products

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from Site all such work after use.

1.2 HOARDING

.1 Provide hoarding and ventilation for the building as required to maintain operation of the pumping station.

1.3 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, and any other fall hazards

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

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

.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.

1.5 FIRE ROUTES

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

1.6 SITE EASEMENTS

.1 Manitoba Hydro maintains a site easement of five metres on either side of the overhead transmission lines on the Site that run parallel to the east face of the McPhillips Pumping Station and from the southeast corner of the McPhillips Pumping Station to Manitoba Hydro's substation at 1149 Logan Avenue. The easement extends to any excavations in the area and no structure shall be more than 3.65 metres above the ground level or 5.2 metres from the overhead conductors.

.2 Manitoba Hydro maintains a site easement of 6.0 metres in width from the south limit of Hurst way and 7.62 metres on either side of the centre of the overhead transmission lines extending in a south westerly direction from the north western corner of the pumping station Site. The easement extends to any excavations in the area and no structure shall be more than 3.65 metres above the ground level or 5.2 metres from the overhead conductors.

.3 Any damage to Manitoba Hydro and/or Centra Gas infrastructure must be reported and repaired, at no cost to Manitoba Hydro, Centra Gas or the City. In the event that Manitoba Hydro or Centra Gas perform the repairs, the Contractor will be responsible for the costs. All damages must be repaired prior to any operations, such as backfilling.

.4 Prior to commencing any construction contact “Click Before you Dig”.

1.7 TEMPORARY OVERHEAD DOOR

.1 Overhead door entries to be securely enclosed during the Work. The contractor to provide a secure means to enclose/seal the overhead door entries during overhead door replacement when door is temporarily removed. Contractor to provide method of securing overhead door entries during this Work to the Contract Administrator for approval prior to proceeding.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Conform to reference standards, in whole or in part as specifically requested in the Specifications.

.2 If there is question as to whether products or systems are in conformance with applicable standards, the Contract Administrator reserves the right to have such products or systems tested to prove or disprove conformance.

.3 Cost for such testing will be born by the City in event of conformance with the Contract or in event of non-conformance with the Contract the City shall deduct such costs from the Contract, amount of which will be determined by the Contract Administrator.

1.2 QUALITY

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

.2 Defective products, whenever identified prior to completion of the 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 Contactor's own expense and be responsible for delays and expenses caused by rejection. Should disputes arise as to quality or fitness of products, decision rests strictly with the Contract Administrator based upon requirements of Contract.

.3 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout each pumping station and the project.

1.3 AVAILABILITY

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

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

1.4 METRIC PROJECT

.1 Unless otherwise noted, this project has been designed and is to be constructed in the International System (SI) of Units metric system of measurements.

.2 During construction, when specified metric elements are unattainable at the time they are required to meet the construction schedule, the Contractor shall notify the Contract

Administrator in writing and suggest alternative substitutions. Costs due to these substitutions shall be borne by the Contractor.

1.5 STORAGE, HANDLING AND PROTECTION

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

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the 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, lumber, and similar products on flat, solid supports and keep clear of ground. Slope to shed moisture.

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

.8 Remove and replace damaged products at own expense and to satisfaction of the Contract Administrator.

.9 Touch-up damaged factory finished surfaces to Contract Administrator’s satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.6 TRANSPORTATION

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

1.7 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in the 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 the Contract Administrator in writing, of conflicts between the Specifications and the manufacturer's instructions, so that the Contract Administrator will establish the course of action.

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

1.8 REMEDIAL WORK

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

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

1.9 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 the 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.

1.10 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill, or sleeve load bearing structural member, unless specifically indicated without written approval of the Contract Administrator.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 WORKMANSHIP

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

.2 Do not employ anyone unskilled in their required duties.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Submit written request to the Contract Administrator in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project Work.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of the City or separate contractor.

.3 Include in the written request:

- .1 Identification of project.
- .2 Location and description of the affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of the proposed Work and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on the Work of the City or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time the Work will be executed.
- .9 Submit datasheet of concrete scanning device for review prior to utilizing. Indicate concrete depths, as well as confirm the ability of the device to perform measurements through this depth.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures. Clearly indicate the requested substitution.

1.3 PREPARATION

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

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

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

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

.5 Provide protection from elements for areas which are to be exposed by uncovering the Work; maintain excavations free of water.

.6 Exercise care where cutting holes in existing concrete elements so as not to damage existing reinforcing or conduit.

.1 For reinforced concrete floors, locate existing reinforcing and conduit by X-Ray or Ground Penetrating Radar scanning and mark out on the surface of the concrete prior to cutting.

.1 Mark the location of the proposed hole and all adjacent rebar and conduits.

.2 Obtain approval from the Contract Administrator prior to cutting.

.2 Concrete scanning device shall to be capable of detecting rebar and conduit in the full depth of the floor.

.7 The Contractor shall exercise care where installing anchors into existing concrete elements so as not to damage existing reinforcing. All anchors shall be installed utilizing carbide tip drill bits. The existing reinforcing shall be located utilizing a reinforcing bar locator and marked out on the surface of the concrete. The drill holes shall be advanced to the required depth for installation of the anchors. Should reinforcement be encountered while drilling, terminate the hole and reposition to clear the reinforcement. Do not use core bits that can easily intercept and damage/cut the reinforcing during drilling. Patch and repair damages.

1.4 EXECUTION

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

.2 Provide openings in non-structural elements of the Work for penetrations of the electrical Work.

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

.4 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools are not allowed on masonry work without prior approval. Where significant removals are required, the Contractor to engage a Professional Engineer and provide sealed Shop Drawings for modifications.

.5 Restore work with new products in accordance with the requirements of the Contract.

.6 Seal penetrations for pipes, sleeves, ducts, conduit, and other systems through surfaces.

.7 Penetrations though a floor above another space shall have a pipe sleeve extending above the floor to prevent water running to the floor below.

.8 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with approved fire stopping material, full thickness of the construction element.

.9 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

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 PROJECT CLEANLINESS

.1 Maintain the Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the City or other contractors.

.2 Remove waste materials from the Site at daily regularly scheduled times or dispose of as directed by the Contract Administrator. Do not burn waste materials on the Site.

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

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

.5 Provide on-site containers for collection of waste materials and debris. Asbestos Containing Material shall be kept separate from other waste material and debris.

.6 Dispose of waste materials and debris off site. Asbestos Containing Material shall be shipped off site to an approved landfill in a separate covered vehicle.

.7 Clean interior areas prior to start of finishing Work, and maintain areas free of dust and other contaminants during finishing operations.

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

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

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

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

.12 Clean and maintain washroom facilities utilized by construction staff on a daily basis.

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 SUBMITTALS

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

.2 Copy will be returned after final inspection, with Contract Administrator's comments.

.3 Revise content of documents as required prior to final submittal.

.4 Furnish evidence, if requested, for type, source and quality of products provided.

.5 Pay costs of transportation.

1.2 OPERATION AND MAINTENANCE MANUALS

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

.2 Operation and maintenance instructions and technical data to be sufficiently detailed with respect to design elements, construction features, component function, correct installation procedure, and maintenance requirements to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of installation. Technical data to be in the form of approved Shop Drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.

.3 One advance copy of the operation and maintenance manuals shall be submitted prior to Total Performance of the Work for review and comments. After review and acceptance by the City, three hard copies and one electronic (PDF) copy of the final operation and maintenance manuals shall be submitted. The final electronic copy shall be provided on a flash memory drive.

.4 For the guidance of the City's operation and maintenance personnel, the Contractor shall prepare operation and maintenance manuals for the Work, describing in detail the construction of each part of the Work and the recommended procedure for operation, servicing, and maintenance.

.5 All instructions in these operation and maintenance manuals shall be in simple language to guide the City in the proper operation and maintenance of this installation.

.6 In addition to information called for in the Specifications, include the following:

- .1 Overall Title sheet labelled "Operation and Maintenance Instructions", and containing project name and date, facilities covered in the manual, City's Contract number, the name and address of the Contractor, and the issue date.
- .2 Overall list of contents, indicating the facilities upgraded by the project.
- .3 Title sheet for each section, labelled "Operation and Maintenance Instructions", the applicable facility, and containing project name and date.
- .4 List of contents for each section.
- .5 Include:

.1 All equipment and systems documentation shall have project specific equipment tags clearly indicating the systems.

.2 Brochures/catalogue excerpts of all components of the Work. Please include only relevant components associated with the work from the brochures/catalogs along with the brochure covers. Do not include entire catalog of vendor products.

.3 Survey record of underground systems (cables, conduit, piping, etc.). Provide precise location of all buried systems.

.4 Documentation of all test results.

.5 Complete set of equipment and assembly drawings.

.6 Installation, start-up, individual equipment operation and maintenance manuals.

.7 Any specific requirements from the Specifications.

.8 Shop Drawings and cutsheets of all equipment and materials,

.1 Do not utilize the cutsheet and Shop Drawing submittals that were sent to the Contract Administrator for review as these may contain inaccurate information and markups. Only provide cutsheets and Shop Drawings representing the final materials and equipment supplied, without any markups from the Contract Administrator.

.2 For generic cutsheets and Shop Drawings that list multiple model numbers or configurations, place a rectangle around the specific model that was supplied and cross out other models.

.9 Include sections for the record Drawings and as-built Drawings of all installations. Drafted record Drawings and as-built Drawings of size 432x279mm (11 x 17") will be inserted by the Contract Administrator, based on the as-built Drawings marked up by the Contractor.

.10 Names, addresses, and telephone numbers of all major Subcontractors and suppliers.

.11 Certificate of Inspection from the Inspection Authority.

.12 Testing and commissioning documentation.

.13 Warranty certificate, signed and dated.

.14 Written process narratives/functional requirement specification outlining the programming of the PLC systems for individual processes or systems.

.15 Final instrumentation set points including but not limited to:

.1 Units

.2 Scale

.3 Alarm points (low-low, low, high, high-high)

.4 4-20 mA settings

.7 Provide separate operation and maintenance manuals as follows:

.1 Maclean Pumping Station Chlorine Upgrades -HVAC.

.2 Maclean Pumping Station Chlorine Upgrades -Electrical and Instrumentation.

.3 McPhillips Pumping Station Chlorine Upgrades -HVAC.

.4 McPhillips Pumping Station Chlorine Upgrades -Electrical and Instrumentation.

.5 Hurst Pumping Station Chlorine Upgrades -HVAC.

.6 Hurst Pumping Station Chlorine Upgrades -Electrical and Instrumentation

.8 Modify and supplement the operation and maintenance manuals as required by the Contract Administrator.

.9 Format to be as follows:

.1 Binders: vinyl, hard covered, 3 'D' ring, with spine and face pockets.

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

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

1.3 AS-BUILT / RECORD DRAWINGS

.1 After award of Contract, the Contract Administrator will provide a complete set of Drawings for the purpose of maintaining project as-built and record Drawings Accurately mark up deviations from the Contract caused by the Site conditions and changes ordered by the Contract Administrator. Update daily.

.2 The Contractor shall keep one (1) complete set of white prints at the Site during the Work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of the as-built and record Drawings. As the Work on-site proceeds, the Contractor shall clearly mark up the white prints in red pencil all the Work which deviated from the original Contract. The marked up information is to include locations of all devices, circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all equipment.

.3 Identify Drawings as "Project Record Copy". Maintain in good condition and make available for inspection on-site by the Contract Administrator at all times.

.4 On completion of each facility, submit record / as-built Drawings to the Contract Administrator for review.

1.4 SPARE PARTS

.1 Submit spare parts as indicated in the individual Specification sections.

1.5 MAINTENANCE TOOLS

.1 Submit maintenance tools as indicated in the individual Specification sections.

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 PURPOSE

.1 This specification identifies specific site conditions and basis of design for each location of work.

1.2 DESIGN BASIS

.1 The following table specifies the outdoor site conditions at each location of work.

PROJECT	HURST	MCLEAN	MCPHILLIPS
Building Size (Approx.)(1)	90'x 70'	182' x 50'	92' x 60'
Latitude(1)	49.84638	49.88154	49.91570
Longitude(1)	-97.17697	-97.070174	-97.17118
Site Elevation(2)	228.0 m (748.0 ft)	226.0 m (741.5 ft)	235.0 m (771.0 ft)
Water Availability	City Water Available	City Water Available	City Water Available
Maximum Annual Temperature (Mean)(3)	26.0°C		
Minimum Annual Temperature (Mean)(3)	-21.0°C		
Extreme Maximum Annual Temperature(4)	37°C		
Extreme Minimum Annual Temperature(5)	-42°C		
Days/Year with Max Temp:(6)			
>10°C (50°F)	184		
>20°C (68°F)	110		
>30°C (86°F)	13		
Days/Year with Min Temp:(6)			
<-10°C (14°F)	102		
<-20°C (-4°F)	52		
<-30°C (-22°F)	13		
Wind:			
Prevailing Wind Direction(7)	270°		
Mean Wind Speed(8)	19 kph (12 mph)		
Extreme Annual Wind Speed(9)	87 kph (54 mph)		
Rain:			
Annual Total(8)	520 mm (20.5 in)		
Seismic Zone: (10)			
Sa(0.2)	0.12		
Sa(0.5)	0.056		
Sa(1.0)	0.023		
Sa(2.0)	0.006		
Peak Horizontal Ground Acceleration (PGA)	0.059		
Snow Load (1/50): (11)			

Ss (Ground Snow Load)	1.9 kPa (0.28 psi)
Sr (Rain Load)	0.2 kPa (0.03 psi)
Snow: (12)	
Extreme Max Daily	30 cm (11.8 in)
Average Annual Depth	114 cm (44.8 in)

(1) https://www.google.ca/maps
(2) https://www.freemaptools.com/elevation-finder.htm
(3) https://www.holiday-weather.com/winnipeg/averages/
(4) https://www.currentresults.com/Yearly-Weather/Canada/MB/Winnipeg/extreme-annual-winnipeg-high-temperature.php
(5) https://www.currentresults.com/Yearly-Weather/Canada/MB/Winnipeg/extreme-annual-winnipeg-low-temperature.php
(6) https://www.currentresults.com/Weather/Canada/Manitoba/Places/winnipeg-temperatures-by-month-average.php
(7) https://winnipeg.weatherstats.ca/metrics/wind_direction.html
(8) https://www.climatestotravel.com/climate/canada/winnipeg
(9) https://winnipeg.weatherstats.ca/charts/wind_speed-yearly.html
(10) https://earthquakescanada.nrcan.gc.ca/hazard-alea/OF4459/of4459table1-en.php
(11) https://wwtams.com/wp-content/uploads/2020/03/GSL-Mar2012.pdf
(12) https://www.currentresults.com/Weather/Canada/Manitoba/Places/winnipeg-snowfall-totals-snow-accumulation-averages.php

.2 The following table specifies the indoor site conditions at each location of work.

PROJECT	HURST	MCLEAN	MCPHILLIPS
Expected Chlorine Concentration	1 ppm		
Temperature Setpoint – Heating (OAT<21°C)	21°C		
Temperature Setpoint – Cooling	N/A – No Cooling		

1.3 ELECTRICAL SYSTEMS

.1 The following table specifies the electrical and transmission site requirements.

PROJECT	HURST	MCLEAN	MCPHILLIPS
Site Voltage	600V/3ph/60Hz	600V/3ph/60Hz	600V/3ph/60Hz
Distribution Panel	600V	600V	120/208V
Transformers	500kVA 4160-600V	300kVA 4160-600V	500kVA 4160-600V

1.4 ENVIRONMENTAL PROTECTION

.1 Air Emissions

.1 The system shall be designed to remove a minimum of 99.99% of chlorine vapour in a single pass (discharge not to exceed 5 ppm).

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes the following:

- .1 Demolition and removal of buildings and structures
- .2 Demolition and removal of site improvements adjacent to a building or structure being demolished
- .3 Removing below grade construction
- .4 Disconnecting, capping or sealing, and abandoning in place site utilities

1.2 RELATED REQUIREMENTS

.1 Section 22 05 05 - Selective Demolition for Plumbing

.2 Section 02 82 00.02 - Asbestos Abatement - Intermediate Precautions

1.3 DEFINITIONS

.1 Demolition: rapid destruction of building following removal of hazardous materials.

.2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly.

1.4 REFERENCE STANDARDS

.1 Canada Green Building Council (CaGBC)

- .1 LEEDr Reference Guide for Building Design and Construction, Version 4

.2 CSA Group (CSA)

- .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.3 Department of Justice Canada (Jus)

- .1 Canadian Environmental Assessment Act (CEAA), 2012
- .2 Canadian Environmental Protection Act (CEPA), 2012
  - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
  - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations
  - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34

.4 Motor Vehicle Safety Act (MVSA), 1995

.5 Hazardous Materials Information Review Act, 1985

.4 National Fire Protection Association (NFPA)

.1 NFPA 241 - 96, Standard for Safeguarding Construction, Alteration, and Demolition Operations

.5 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

.2 National Fire Code of Canada 2015 (NFC).

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S660-08, Standard for Nonmetallic Underground Piping for Flammable and Combustible Liquids

.2 ULC/ORD-C58.15-1992, Overfill Protection Devices for Flammable Liquid Storage Tanks

.3 ULC/ORD-C58.19-1992, Spill Containment Devices for Underground Flammable Liquid Storage Tanks

.7 United States Environmental Protection Agency (EPA)/Office of Water

.1 EPA CFR 86.098-10, Emission standards for 1998 and later model year Otto-cycle heavy-duty engines and vehicles

.2 EPA CFR 86.098-11, Emission standards for 1998 and later model year diesel heavy-duty engines and vehicles

.3 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with Contract Administrator for the material ownership including but not limited to:

.1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Cities property, demolished materials shall become Contractor's property and shall be removed from Project site.

.2 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Contract Administrator that may be encountered during demolition remain Cities property.

.2 Pre-Demolition Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor and Contract Administrator.

.3 Scheduling:

.1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.

.2 In event of unforeseen delay notify Contract Administrator in writing.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Shop Drawings: Submit drawings stamped and signed by professional engineer registered or licensed in Province as follows:

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

.2 Informational Submittals: Provide the following submittals when requested by the Contract Administrator:

.1 Qualification Data: Submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of Contract Administrator, for work of similar complexity and extent.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Ensure Work is performed in compliance with applicable Provincial/Territorial and Municipal regulations.

.2 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

.3 Standards: Comply with ANSI A10.6 and NFPA 241.

1.8 SITE CONDITIONS

.1 Review "Designated Substance Report" and take precautions to protect environment.

.2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures as covered in Section 02 82 00.02 - Asbestos Abatement - Intermediate Precautions.

.3 Notify Contract Administrator before disrupting building access or services.

.4 Environmental protection:

.1 Ensure Work is done in accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

.1 Not Applicable.

Part 3 Execution

3.1 EXAMINATION

.1 Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

.2 Review Project Record Documents of existing construction provided by Contract Administrator.

.3 Contract Administrator does not guaranty that existing conditions are the same as those indicated in Project Record Documents.

.4 Inventory and record the condition of items being removed and salvaged.

.5 When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element.

.6 Promptly submit a written report to Contract Administrator.

.7 Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during demolition operations.

.8 Verify that hazardous materials have been remediated before proceeding with demolition operations.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to: requirements of authorities having jurisdiction.

.2 Protection of In-Place Conditions:

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, landscaping features and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.3 Demolition/Removal:

.1 Demolish parts of structures as indicated.

.2 Removal of Pavements, Curbs and Gutters:

.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Contract Administrator.

.2 Protect adjacent joints and load transfer devices.

.3 Remove parts of existing building to permit new construction.

.4 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

.5 At end of each day's work, leave Work in safe and stable condition.

.6 Protect interiors of parts not to be demolished from exterior elements at all times.

.7 Demolish to minimize dusting. Keep materials wetted as directed by Contract Administrator.

.8 Only dispose of material specified by selected alternative disposal option as directed by Contract Administrator.

3.3 SITE RESTORATION & REPAIRS

.1 Provide a smooth transition between adjacent existing grades and new grades.

.2 General: Promptly repair damage to adjacent construction caused by demolition operations.

.3 Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

.4 Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.4 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Refer to demolition drawings and specifications for items to be salvaged for reuse.

.4 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Both confirmed asbestos and presumed asbestos have been identified at the McPhillips Regional Pumping Station, McPhillips Chlorine Building, , Hurst Regional Pumping Station, and Maclean Regional Pumping Station, which will or may be affected by the Work. Refer to the following Hazardous Materials Information Systems (HMIS) reports for further details:

.1 2023 Asbestos Reassessment Report – WD Hurst Pumping Station -2023-08-16

.2 2023 Asbestos Reassessment Report – McPhillips Street Pumping Station - 2023-08-22

.3 2023 Asbestos Reassessment Report – GC Macleant Pumping Station & Reservoir -2023-08-14

.2 The presumed asbestos containing materials (ACMs) detailed in the appended HMIS reports shall be assumed to be ACM.

.3 The Contractor is responsible for the removal and disposal of all confirmed ACMs and presumed ACMs affected by the Work as indicated on the Asbestos Reports listed above. Material including but not limited to:

.1 Plaster
.2 Vermiculite
.3 Parging over Fibreglass
.4 Sweat Wrape Pipe Insulation
.5 Mortar
.6 Drywall
.7 Transite
.8 Terrazzo
.9 Parging Cement
.10 Lay-in Ceiling Tiles
.11 Adhesive/Mastic
.12 Ceramic Tiles
.13 Concrete.

.4 Where penetrations through confirmed or presumed ACMs are required, the Contractor shall conduct the Work in accordance with this section.

.5 The Contractor shall put in place a removal / disposal work plan and shall remove all confirmed and presumed ACMs to perform the work as indicated on the Contract documents and as indicated in Appendix B which impact the Contractors activities, in a safe manner, as part of the required Work.

.6 Provide training for all workers, including but not limited to:

.1 Contractor’s workers

.2 Visitors

.3 Contract Administrator and his designated on-site staff

.7 Comply with requirements of this section when performing the following Work:

.1 Removing non-friable ACMs by breaking, cutting, drilling, abrading, grounding, sanding, or vibrating to accommodate work at locations indicated on the Drawings. If the Work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.

.2 Removing of all friable ACMs by wetting.

.3 Removing of ACM from a pipe, duct, or similar structure using a glove bag.

.8 The Contractor shall ensure that work does not impeded with the ongoing operations of the facility. The facility will continue to be operated by City staff.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.205-94, Sealer for Application of Asbestos Fibre Releasing Materials.

.2 Department of Justice Canada (Jus)

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

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS) 2015

.1 WHMIS Safety Data Sheets (SDS).

.4 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Underwriters' Laboratories of Canada (ULC)

1.3 DEFINITIONS

.1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.2 Asbestos Containing Materials (ACMs): materials identified herein, and in the appended HMIS Confirmed Asbestos and Presumed Asbestos reports for each building.

.3 Asbestos Abatement Monitoring & Inspection Agent: a person qualified to provide asbestos abatement monitoring and inspection services in the jurisdiction where the services are to be provided. The Asbestos Abatement Monitoring & Inspection Agent shall be retained by the Contractor via the cash allowance included in the Contract.

.4 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.

.5 Authorized Visitors: Contract Administrator, or designated representative, and representative of regulatory agencies.

.6 Friable Materials: material that when dry can be crumbled, pulverized, or powdered by hand pressure and includes such material that is crumbled, pulverized, or powdered.

.7 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.

.2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.

.4 Straps for sealing ends around pipe.

.5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.

.8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.9 Minor Amounts of ACMs: less than or equal to 0.1 m^2 of friable material containing chrysotile asbestos.

.10 Non-Friable Material: material that when dry cannot be crumbled, pulverized, or powdered by hand pressure.

.11 Occupied Area: any area of building or work site that is outside the Asbestos Work Area.

.12 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.13 FR Polyethylene: fiber re-enforced polyethylene.

.14 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of Work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit proof satisfactory to Asbestos Abatement Monitoring & Inspection Agent that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

.3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.4 Submit proof of insurance in accordance with D14 of the tender.

.5 Submit to Asbestos Abatement Monitoring & Inspection Agent and to the Contract Administrator necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.

.6 Submit proof satisfactory to Asbestos Abatement Monitoring & Inspection Agent and to the Contract Administrator that the Contractor’s employees and all visitors to the area have had instruction on hazards of asbestos exposure, respirator use, dress, entry and exit from Asbestos Work Area, and aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning, and disposal of respirators and protective clothing.

.7 Submit proof that the Contractor’s supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by the Asbestos Abatement & Inspection Agent and to the Contract Administrator.

.8 Submit documentation including test results, fire and flammability data, and WHMIS Safety Data Sheets (SDS) for chemicals or materials including:

.1 Encapsulants;

.2 Amended water;

.3 Slow drying sealer.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial, and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these Specifications more stringent requirement applies. Comply with regulations in effect at the time the Work is performed.

.2 Health and Safety:

.1 Safety Requirements: Provide all requirements for workers and Authorized Visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

.1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected, and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. Replace damaged or deteriorated respirator parts prior to the respirator being used by a worker and, when not in use, store respirators in a convenient, clean, and sanitary location. The Contractor to establish written procedures regarding the selection, use, and care of respirators and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. Do not assign a worker to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the Contractor for all of the Contractor’s personnel and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.3 Before leaving Asbestos Work Area, the worker or Authorized Visitor must decontaminate his or her protective clothing prior to removing the protective clothing by using a vacuum equipped with a HEPA filter or by damp wiping. If the protective clothing will not be reused, decontamination is not required and place the protective clothing in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.4 Ensure workers and Authorized Visitors wash hands and face when leaving Asbestos Work Area.

.5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.6 Visitor and Contract Administrator Protection:

.1 Provide protective clothing and approved respirators to the Contract Administrator and Authorized Visitors to Asbestos Work Area.

.2 Instruct the Contract Administrator and Authorized Visitors in the use of protective clothing, respirators, and procedures.

.3 Instruct the Contract Administrator and Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, and Regional and Municipal regulations.

.3 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial, and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mils bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.7 EXISTING CONDITIONS

.1 Notify Contract Administrator of friable material discovered during Work and not apparent from Drawings, Specifications, or report pertaining to Work. Do not disturb such material until instructed by Contract Administrator.

1.8 SCHEDULING

.1 All Work will be carried out so as not to affect normal operations of the facility taking place at the time of the abatement.

.2 Co-ordinate Work schedule with the Asbestos Abatement Monitoring & Inspection Agent.

1.9 PERSONNEL TRAINING

.1 Before beginning Work, provide via the Asbestos Abatement Monitoring & Inspection Agent satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

Part 2 Products

2.1 MATERIALS

.1 Drop and Enclosure Sheets:

.1 Polyethylene: 0.15 mm thick.

.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of ACM.

.3 Waste Containers: contain waste in two separate containers.

.1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.

.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

.3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.

.4 Glove Bag:

.1 Acceptable materials: safe-T-Strip products in configuration suitable for Work or approved equal in accordance with B7.

.2 The glove bag to be equipped with:

.1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.

.2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct, or similar structure.

.3 A tool pouch with a drain.

.4 A seamless bottom and a means of sealing off the lower portion of the bag.

.5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.

.5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.6 Slow - Drying Sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.1 Sealer: flame spread and smoke developed rating less than 50.

.7 Encapsulant: Serpiflex Shield or approved equal in accordance with B7.

Part 3 Execution

3.1 SUPERVISION

.1 Minimum of one supervisor for every ten workers is required.

.2 Approved supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

.1 Before beginning Work at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.2 Before beginning Work, remove visible dust from surfaces in Asbestos Work Area where dust is likely to be disturbed during course of Work.

.1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.

.2 Do not use compressed air to clean up or remove dust from any surface.

.3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.

.1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and work areas where dust or contamination cannot otherwise be safely contained.

.2 When removing ACM from piping or equipment where the "glove-bag" method is not used, erect enclosure of polyethylene sheeting around work area, shut off

mechanical ventilation system serving work area, and seal ventilation ducts to and from work area.

.4 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.

.1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.

.2 Perform Work in a manner to reduce dust creation to lowest levels practicable.

.5 Pipe Insulation Removal Using Glove Bag:

.1 A glove bag is not to be used to remove insulation from a pipe, duct, or similar structure if:

.1 It may not be possible to maintain a proper seal for any reason including, without limitation:

.1 The condition of the insulation.

.2 The temperature of the pipe, duct, or similar structure.

.2 The bag could become damaged for any reason including, without limitation:

.1 The type of jacketing.

.2 The temperature of the pipe, duct, or similar structure.

.2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag is to be inspected at regular intervals for damage and defects and repaired or replaced as appropriate. The asbestos containing contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.

.3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.

.4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in the bag to obtain the full capacity of the bag.

.5 Insert nozzle of garden reservoir type sprayer into the bag through the valve and wash down the pipe and interior of bag thoroughly. Wet the surface of the insulation in the lower section of the bag.

.6 To remove the bag after completion of stripping, wash top section and tools thoroughly. Remove the air from the top section of the bag through the elasticized valve using a HEPA vacuum. Pull the polyethylene waste container over the glove bag before removing the bag from the pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove the second strap and zipper. Fold over into waste container and seal.

.7 After removal of the bag, ensure that the pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of the pipe and ends of insulation with slow drying sealer to seal in any residual fibres.

.8 Upon completion of the Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.

.6 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas. The costs of clean-up of affected surrounding areas due to contamination shall be borne by the Contractor and no adjustments to the Contract price will be permitted.

.7 Cleanup:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area for disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from Site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, the Asbestos Abatement Monitoring & Inspection Agent shall take air samples on a daily basis outside of the Asbestos Work Area enclosure in accordance with Health Canada recommendations.

.1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial Occupational Health and Safety Regulations.

.2 Submit daily air monitoring results and recommendations to the Contract Administrator.

.2 If air monitoring shows that areas outside Asbestos Work Area enclosure are contaminated, enclose, maintain, and clean these areas in same manner as that applicable to Asbestos Work Area. The costs to enclose, maintain, and clean-up these areas shall be borne by the Contractor and no adjustments to the Contract price will be permitted.

.3 Ensure that respiratory safety factors are not exceeded.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 The City of Winnipeg (CW)

.1 CW 2160.
.2 CW 3230.
.3 CW 3410.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
.2 CAN/CSA-A23.2, Methods of Test for Concrete.
.3 CAN/CSA-A3000-A5, Portland Cement.
.4 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

1.2 SUBMITTALS

.1 Shop Drawings

.1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.

.2 Construction Method

.1 No work shall commence on construction of wastewater pumping station concrete work until after the Contract Administrator's review of the Contractor's Construction Method submission.
.2 The Contractor shall prepare for the Contract Administrator's review a Construction Method submission detailing:
.3 Construction sequence to be followed including all methods to be employed to ensure no damage occurs to existing structures or adjacent properties within or adjacent to the Works.
.4 Submission to include proposed method of pumping station construction, specialized equipment to be used, and any design revisions proposed to accommodate the Contractor's proposed construction method.
.5 The Contractor shall respond to any concerns that may be raised by the Contract Administrator after review of Construction Method submission.

Part 2 Products

2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A3000-A5, Type HS or HSb.

.2 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.

.3 Premoulded joint filler:

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.1 Bituminous impregnated fibreboard: to ASTM D1751.

.4 Joint sealer/filler: to CAN/CGSB-19.24, Type 1, Class B.

.5 Sealer: proprietary poly-siloxane resin blend.

.6 Other concrete materials: to CAN/CSA-A23.1.

.7 Void Form: Frost Cushion as manufactured by Beaver Plastics or approved equal in accordance with B7.

2.2 MIXES

.1 Proportion concrete in accordance with CAN/CSA-A23.1 and CW 2160.

.2 Concrete: concrete design shall be in accordance with performance specification and shall have the following properties:

.1 Cement: Type HS or HSb.
.2 Minimum Compressive Strength @ 28 days: 35 MPa
.3 Slump: 80 +/- 20 mm
.4 Air Content: 5 – 8% +/- 1%
.5 Maximum Water/Cement Ratio = 0.40

.3 Class of exposure: S-1 to CAN/CSA-A23.1.

.4 Nominal maximum size of coarse aggregate: 20mm and to CAN/CSA-A23.1.

.5 Air content: concrete to contain purposely entrained air in accordance with CAN/CSA-A23.1.

.6 Admixtures: to CAN/CSA-A23.1.

.7 Grout: Sika Grout 212 or approved equal in accordance with B7.

.8 Masonry Fill: concrete design shall be in accordance with performance specification and shall have the following properties:

.1 Cement: Type GU.
.2 Minimum Compressive Strength @ 28 days: 20 MPa
.3 Slump: 200 mm
.4 Air Content: nil
.5 Maximum Water/Cement Ratio = 0.49

.9 Bonding Agent: ACRYL-STIX or approved equal in accordance with B7.

Part 3 Execution

3.1 GENERAL

.1 Complete cast-in-place concrete work in accordance with CAN/CSA-A23.1.

.2 Make neat openings in walls and floor slabs using concrete coring and cutting equipment and methods.

.3 Fill openings left in concrete after removal of piping or other equipment with watertight, non-shrink grout. Finish new surfaces flush with the existing surface and match the surrounding surface texture. Primer and paint shall be applied in accordance with Section 09 91 23 if the surrounding surfaces have a paint finish.

.4 Mix and apply grout in accordance with the manufacturer's instructions.

.5 Mix and apply bonding agent in accordance with the manufacturer's instructions.

.6 Neatly grout any concrete surface that has been broken and had the aggregate exposed with a smooth finish similar in texture to that of the surrounding concrete.

.7 Apply concrete bonding agents between new concrete or grout and existing concrete surfaces. Remove all loose, pitted and scaled concrete and apply bonding agent in accordance with the manufacturer's instructions.

.8 De-scale exposed reinforcing steel and have all rust removed before applying grout.

3.2 FORMING

.1 Construct formwork and falsework in accordance with CAN/CSA-A23.1 and CSA S269.1.

.2 Use void form under all grade beams; do not cast grade beams against ground.

3.3 INSERTS

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by the Contract Administrator.

3.4 FINISHES

.1 Formed surfaces exposed to view: sack rubbed finish in accordance with CAN/CSA-A23.1.

.2 Interior floor slabs: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CAN/CSA-A23.1 to produce hard, smooth, dense trowelled surface free from blemishes.

.3 Equipment pads: provide smooth trowelled surface. Provide 25mm chamfers at all outer edges.

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.4 Pavements, walks, curbs and exposed site concrete:

.1 Screed to plane surfaces and use floats.

.2 Provide round edges and joint spacings using standard tools.

.3 Trowel smooth to provide lightly brushed non-slip finish.

3.5 CONTROL JOINTS

.1 Cut form control joints in slabs on grade at locations indicated or to match existing, in accordance with CAN/CSA-A23.1 and install specified joint sealer/filler.

3.6 EXPANSION AND ISOLATION JOINTS

.1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface.

3.7 CURING

.1 Cure and protect concrete in accordance with CAN/CSA-A23.1.

.1 Do not use curing compounds where bond is required by subsequent topping or coating.

3.8 SEALING

.1 Following curing, apply poly-siloxane resin blend sealer at 4 m^2/L or approved equal in accordance with B7.

3.9 SITE TOLERANCES

.1 Concrete floor slab finishing tolerance in accordance with CAN/CSA-A23.1.

3.10 QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be in accordance with CSA A23.1 and carried out by a Testing Laboratory designated by the Contract Administrator. Quality control tests for concrete will be used to determine the acceptability of the concrete supplied.

.2 Provide without charge samples of concrete and constituent materials required for quality control tests and provide assistance and use of tools and construction equipment as is required.

.3 The frequency and number of concrete quality control tests will be in accordance with the requirements of CSA A23.1.

.4 Non-destructive methods for testing concrete will be in accordance with CSA A23.2.

.5 An outline of the quality control testing is as follows.

.1 Samples of concrete for test specimens will be taken in accordance with CSA A23.2-1C.

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.2 Slump tests will be performed in accordance with A23.2-5C. If measured slump falls outside limits specified a second test will be made. In the event of a second failure the Contract Administrator reserves right to refuse the batch of concrete represented.

.6 Non-destructive methods for testing concrete will be in accordance with CSA A23.2. Air content test will be performed in accordance with CSA A23.2-4C. If measured air content falls outside limits specified in Table CW 2160.1 a second test will be made at any time within the specified discharge time limit for the mix. In the event of a second failure the Contract Administrator reserves the right to reject the batch of concrete represented.

.7 Compressive strength test specimens will be taken in accordance with CSA A23.2-3C.

.8 Compressive strength tests at 28 days will be the basis for acceptance of all concrete supplied. For each 28 day test the strength of two companion standard-cured test specimens will be determined in accordance with CSA A23.2-9C. Test result will be the average strength of both specimens.

.9 Field Inspection: A minimum of twenty-four (24) hours notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for observation of reinforcing steel.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 City of Winnipeg (CW)

.1 CW 2160

.2 American Concrete Institute (ACI)

.1 SP-66, ACI Detailing Manual 2004.

.1 ACI 315, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.3 CSA International

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

.2 CSA-A23.3, Design of Concrete Structures.

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

.4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 The Contractor shall submit shop drawings for the Contract Administrator's approval two (2) weeks prior to the fabrication of any reinforcing steel.

.2 The Contractor shall provide, without charge, the samples of reinforcing steel required for quality control tests and provide such assistance and use of tools and construction equipment as is required.

.3 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

.4 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered in the Province of Manitoba.

.1 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.2 Detail lap lengths and bar development lengths to CSA-A23.3.

1.3 QUALITY ASSURANCE

.1 Submit:

.1 Mill Test Report: Upon request, provide the Contract Administrator with certified copy of mill test report of reinforcing steel a minimum of 4 weeks prior to beginning reinforcing work.

.2 Upon request submit in writing to the Contract Administrator the proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18.

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

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

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

.1 Bar accessories shall be of type approved by the Contract Administrator. They shall be made from a non-corroding material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete. Bar chairs are to be PVC; galvanized bar chairs are not acceptable.

.2 Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract Administrator. Bar accessories are not shown on the Contract Drawings. The supply and installation of bar accessories shall be considered incidental to the supply and placing of reinforcing steel.

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

.6 Replace defective or damaged materials with new.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315, CW 2160, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

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

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide the Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request inform the Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where authorized by the Contract Administrator.

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

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

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

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

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

.3 Prior to placing concrete, obtain the Contract Administrator’s approval of reinforcing material and placement.

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

.5 A minimum of twenty-four (24) hours notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for observation of reinforcing steel.

3.3 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA A165, CSA Standards on Concrete Masonry Units
- .2 CSA A179, Mortar and Grout for Unit Masonry.
- .3 CSA A370, Connectors for Masonry.
- .4 CSA A371, Masonry Construction for Buildings.
- .5 CSA G30.14, Deformed Steel Wire For Concrete Reinforcement.
- .6 CSA G30.18, Billet-Steel Bars for Concrete Reinforcement.
- .7 CSA S304.1, Masonry Design for Buildings.
- .8 CSA A82.1, Burned Clay Brick (Solid Masonry Units Made From Clay or Shale).

1.2 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Sections 01 33 00 - Submittal Procedures.

.2 Shop Drawings :

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings consist of bar bending details, lists and placing drawings.
- .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

Part 2 Products

2.1 MASONRY UNITS

.1 Standard concrete block units: to CSA A165 Series, to match existing and face finish.

- .1 Classification: As indicated on drawings, for load bearing walls.
- .2 Size: modular
- .3 Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

2.2 REINFORCEMENT AND CONNECTORS

.1 Bar reinforcement: to CSA A371 and CSA G30.18, Grade 400.

.2 Wire reinforcement: to CSA A371 and CSA G30.14, truss type.

.3 Connectors shall be corrosion resistant: to CSA A370 and CSA-S304.

2.3 MORTAR AND GROUT

.1 Mortar: to CSA A179.

.1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.2 Colour: ground coloured natural aggregates or metallic oxide pigments.

.2 Mortar Type: S 25 MPa strength,

.3 Grout: to CSA A179, Table 3.

2.4 ACCESSORIES

.1 Weep hole vents: purpose-made PVC, where required.

.2 Nailing Inserts: 0.5 mm minimum thickness, galvanized.

.3 Bolts: 12 mm diameter x 150 mm long with ends bent 50 mm at 90 degrees or others as indicated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Do masonry work in accordance with CSA A371 except where specified otherwise and to match courses and layout of existing masonry walls:

.1 Bond: running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.

.2 Coursing height: 200 mm, for one block and one joint, for three bricks and three joints. Jointing: tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface as to match existing.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.2 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.

.2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

.2 Building-In:

.1 Install masonry connectors and reinforcement where indicated on drawings.

.2 Build in items required to be built into masonry.

.3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.4 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Install loose steel lintels over openings where indicated.

.3 Concrete block lintels:

.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.2 End bearing: not less than 200 mm or as indicated on drawings.

.4 Support of loads:

.1 Use 25 MPa concrete, where concrete fill is used in lieu of solid units.

.2 Use grout to CSA A179 where grout is used in lieu of solid units.

.3 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

.5 Provision for movement:

.1 Leave 3 mm space below shelf angles.

.2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.3 Built masonry to tie in with stabilizers, with provision for vertical movement.

.6 Interface with other work:

.1 Cut openings in existing work as indicated.

.2 Openings in walls: as reviewed by the Contract Administrator.

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

.7 Build in flashings in masonry in accordance with CSA A371.

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.

.2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:

.1 For masonry backing embed flashing 25 mm in joint.

.2 For concrete backing, insert flashing into reglets.

.3 For wood frame backing, staple flashing to walls behind sheathing paper.

.4 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.

.3 Lap joints 150 mm and seal with adhesive.

.8 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

3.3 REINFORCING AND CONNECTING

.1 Install masonry connectors and reinforcement in accordance with CSA A370, CSA A371 and CSA-S304.1 unless indicated otherwise.

.2 Prior to placing concrete, obtain Contract Administrator's approval of placement of reinforcement and connectors.

3.4 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CSA-S304, CSA-A371 and as indicated.

.2 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CSA A371 and as indicated.

3.5 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA S304.1, CSA A371, and CSA A179.

3.6 GROUTING

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

3.7 ANCHORS

.1 Supply and install metal anchors as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

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

3.9 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA A371 apply.

3.10 FIELD QUALITY CONTROL

.1 Inspection and testing will be carried out by Testing Laboratory designated by the Contract Administrator.

3.11 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

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

3.12 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

- .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes

.2 CSA International

- .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA S16.1, Design of Steel Structures.
- .4 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
- .5 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .6 CSA S157, Strength Design in Aluminum

.3 The Master Painters Institute (MPI)

- .1 Architectural Painting Specification Manual.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit the qualifications of the Contractor, qualifications of operators, shop drawings, mill certificates and welding procedures to the Contractor Administrator for acceptance

.2 Product Data: Submit shop drawings sealed by an engineer registered in the province of Manitoba clearly indicating materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories for the Contract Administrator's approval at least two (2) weeks prior to fabrication. Indicate field measurements on Shop Drawings.

1.3 QUALIFICATION

.1 Fabricator to be fully approved by the Canadian Welding Bureau, in conformance with CSA Standard W.47.1. Welding to be done by currently licensed welders only.

.2 Fabricator to be fully certified in conformance with CSA Standard W47.2. All welding to be done in a licensed welding shop. Obtain Contract Administrator's approval to do field welding.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with 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 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 All materials shall be of a type acceptable to the Contract Administrator, and shall be subject to inspection and testing by the Contractor Administrator.

.2 Material intended for use in the various assemblies shall be new, straight and clean, with well defined profiles.

2.2 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.

.2 Steel pipe: to ASTM A53/A53M seamless, standard weight, galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stud Anchors: to ASTM A108, Grade 1020.

.7 Aluminum: to CSA S157 and the Aluminum Association ‘Specifications for Aluminum Structures’. Aluminum for plates shall be Type 6061-T651. Aluminium plate shall have an approved raised oval or multi-grip pattern.

.1 Stainless Steel sections, plates, and grating: to ASTM A276 grade 304 or 316.

.2 Isolating Sleeves

.1 "Nylite" – headed sleeve as manufactured by SPAE-Nauru of Kitchener, Ontario, or approved equal in accordance with B6.

.3 Aluminum welding shall be in accordance with the requirements of CSA W59.2-M1991.

.4 Hot Dipped Galvanized Steel Repair Material

.1 Galvalloy and Gal-Viz

.5 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

.6 Anchor bolts and fasteners: ASTM A276, Type 316 stainless steel, of ample section to safely withstand the forces created by operation of the equipment or the load to which they will be subjected.

.7 Quantity and size of the fasteners shall be as recommended by the manufacturer or as shown on the Drawings.

.8 Provide exposed fastenings of same material, and finish as the metal to which applied unless indicated otherwise.

.9 Supply all items complete with all anchors and fastenings.

2.3 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Confirm measurements for all fabrications before fabricating.

.3 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.4 Where possible, fit and shop assemble work, ready for erection.

.5 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.6 Seal exterior steel fabrications to provide corrosion protection in accordance with CSA S16.1.

.7 Remove and grind smooth burrs, filings, sharp protrusions, and projections from metal fabrications to prevent possible injury. Correct any dangerous or potentially harmful installations as directed by Contract Administrator.

.8 All aluminum surfaces in contact with concrete shall be isolated using alkali-resistant bituminous paint meeting the requirements of CGSB 31-GP-3M.

.9 Aluminum plate shall have an approved raised oval or multi-grip pattern with edges straight and true, and shall be cut as far as practical to maintain continuity of the pattern at abutting edges.

.10 Pieces shall be of the sizes indicated on the Drawings and shall not be built up from scrap pieces.

.11 Angle frames shall be of the same material as cover plates, and cover plates shall be hinged and be supplied with lifting handles, as required.

.12 Exterior covers shall be supplied with a hasp for a padlock.

.13 Pipe Bollards

.1 Steel pipe: double strong, diameter indicated, hot-dip galvanized.

.2 Concrete: Type HS or HSb sulphate resistant, minimum 20 MPa.

.3 Fabricate and install pipe bollards to be removable as indicated on the Drawings. Set pipe sleeve level and plumb into reinforced concrete footing. Fabricate bollard of steel pipe to fit over top of pipe sleeve and secure to pipe sleeve with 12 mm diameter hot dipped galvanized thru-bolt with nut and washers. Cap top of pipe with 6 mm thick welded steel plate.

.4 Final paint colour as shown on the drawings or as directed by the Contract Administrator, to Section 099123 – Painting.

2.4 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.2 Paint for shop primed ferrous metal surfaces: MPI EXT 5.1D Alkyd G5 (semi gloss) finish, premium grade. Colour Schedule will be provided by the Contract Administrator.

.3 Zinc primer: zinc rich, ready mix.

2.5 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.6 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when materials and air temperatures are lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

.4 Touch up surfaces after installation.

.5 Surface preparation and coatings shall be as per Section 099123 – Painting.

2.7 ANGLE LINTELS

.1 Steel angles: Galvanized, sizes indicated for openings. Provide 150 mm minimum bearing at ends.

.2 Weld or bolt back-to-back angles to profiles as indicated.

2.8 PIPE RAILINGS

.1 Steel pipe: 50 mm nominal outside diameter, formed to shapes and sizes as indicated.

.2 Galvanize pipe railings after fabrication.

2.9 ACCESS LADDERS

.1 Ladders sizes and shapes as indicated, weld 20 mm diameter rungs to stringers, complete with fixing anchors.

.2 Galvanized after fabrication.

2.10 CHANNEL AND HSS ACCESSORIES

.1 Fabricate accessories from steel, sizes as indicated.

.2 Weld channels together to form continuous frame, sizes as indicated.

.3 HSS to be sealed with 6.35 mm steel plate welded completely at each end and ground smooth.

.4 Finish: Surface preparation and shop painted to Section 099123 - Painting, colour as shown on drawings or as directed by the Contract Administrator. Touch up as required after installation.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate.
- .2 Inform the Contract Administrator in writing 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 the Contract Administrator.

3.2 ERECTION

.1 Do steel welding work in accordance with CSA W59 unless specified otherwise.

.2 Do aluminum welding work in accordance with CSA W59.2 unless specified otherwise.

.3 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.4 Provide suitable means of anchorage acceptable to the Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.5 Exposed fastening devices to match finish and be compatible with material through which they pass.

.6 Supply components for work by other trades in accordance with shop drawings and schedule.

.7 Make field connections with bolts to CSA S16 or weld field connection.

.8 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.9 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion.

.10 Repair damaged galvanized surfaces and field welds with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780, Repair of Damaged Hot Dip Galvanizing Coatings. The general procedure shall be to allow a small amount of the repair alloy to flow then spread by brushing briskly with a wire brush. Brushing shall be sufficient to obtain a bright finish. Repeat process three times to ensure a proper thickness is achieved. Temperatures shall be kept below 177ºC (350ºF) at all times. All heating of structural steelwork shall be done in the presence of the Contract Administrator.

.11 Install access hatch frames square and level at the locations show on the Drawings. Embed anchors in concrete as shown on the Drawings. Install covers and adjust hardware to proper function.

.12 Isolate aluminum surfaces in contact with concrete using alkali-resistant bituminous paint meeting the requirements of CGSB 31-GP-3M.

.13 Install electrochemical isolation gaskets and sleeves to electrically isolate dissimilar metals.

3.3 PIPE RAILINGS

.1 Install pipe railings as indicated.

3.4 ACCESS LADDERS

.1 Install access ladders in locations as indicated.

.2 Erect ladders 450 mm clear of wall on bracket supports or as indicated.

3.5 CHANNEL AND HSS ACCESSORIES

.1 Install steel channel frames to openings as indicated.

3.6 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

- .1 ASTM C208, Specification for Cellulosic Fibre Insulating Board.
- .2 ASTM C591, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
- .3 ASTM C612, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
- .4 ASTM C726, Standard Specification for Mineral Fibre Roof Insulation Board.
- .5 ASTM C728, Standard Specification for Perlite Thermal Insulation Board.
- .6 ASTM C1126, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- .7 ASTM C1289-, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .8 ASTM E96/E96M, Standard Test Methods for Water Vapour Transmission of Materials.

.2 Canadian Gas Association (CGA).

- .1 CAN/CGA-B149.1, Natural Gas and Propane Installation Code Handbook.
- .2 CAN/CGA-B149.2, Propane Storage and Handling Code.

.3 Canadian General Standards Board (CGSB)

- .1 CGSB 71-GP-24M, Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.4 Underwriters Laboratories of Canada (ULC).

- .1 CAN/ULC-S604, Standard for Type A Chimneys.
- .2 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .3 CAN/ULC-S102, Surface Burning Characteristics.
- .4 CAN/ULC-S702, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .5 CAN/ULC-S704, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

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

- .1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and data sheet.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

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

Part 2 Products

2.1 INSULATION

.1 Semi-rigid board insulation: mineral (rock slag) wool board to CAN/ULC-S702, thickness & locations as indicated on Drawings, butt edges. Acceptable material: Roxul ComfortBatt or approved equivalent in accordance with B7.

.2 Rigid board: Polyisocyanurate thermal insulation board to CAN/ULC-S704, thickness and locations as indicated on drawings. Acceptable material: Johns Manville “AP Foil-faced” or approved equivalent in accordance with B7..

2.2 ACCESSORIES

.1 Fasteners & adhesives: to be as recommended by the insulation manufacturer, installed per manufacturer’s instructions.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces. Fit insulation tight around electrical, plumbing and heating pipes and ducts, around exterior doors and windows and other penetrations and protrusions. Cut and trim insulation neatly to fit spaces.

.3 Install insulation boards in parallel rows. Butt joints tightly, offset vertical joints. Interlock boards at corners. Use longest pieces possible to reduce number of joints. Cut and trim insulation neatly to fit spaces. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.4 Install insulation boards on outer surface of inner wythe of wall cavity with plastic insulation clips over masonry ties to hold insulation tight to backup wall. Install boards horizontally between masonry ties, with horizontal joints centred on ties.

.5 Install insulation over foundation waterproofing with concrete anchors complete with nailing discs or washers. Provide a minimum of five (5) anchors per 600 x 1200 mm of insulation board. Provide additional anchors spaced at 300 mm on centre around perimeter of openings, corners and abutments. Ensure concrete anchors are securely seated. Replace loose fasteners or provide additional fastener adjacent to loose fasteners. Install insulation to maintain continuity of thermal protection to building elements and spaces.

.6 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.7 Offset both vertical and horizontal joints in multiple layer applications.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Contract Administrator in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

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

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

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include:

.1 Product characteristics.

.2 Performance criteria.

.3 Limitations.

.2 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

Part 2 Products

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.2 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: acoustical sealant compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

.3 Staples: minimum 6 mm leg.

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

Part 3 Execution

3.1 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall, ceiling, and floor assemblies to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI B18.6.4, Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM D2369, Test Method for Volatile Content of Coatings.

.2 ASTM D2832, Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.3 ASTM D5116, Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.4 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-93.2, Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use.

.3 CAN/CGSB-93.3, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.

.4 CAN/CGSB-93.4, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.

.5 CGSB 93.5, Installation of Metal Residential Siding, Soffits and Fascia.

.4 Canadian Standards Association (CSA International).

.1 CSA B111, Wire Nails, Spikes and Staples.

.5 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S706, Wood Fibre Thermal Insulation for Buildings.

1.2 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and data sheets.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

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

Part 2 Products

2.1 SOFFIT & EXPOSED TRIM

.1 Soffit: to CAN/CGSB-93.2, Type B, Class 1, colour to be selected from manufacturer's standard colours, medium gloss, plain pattern surface, flat sheet 'V' crimped for stiffness, vented 0.1 m² of opening for every 30 m² of building area preformed with elongated slits and small perforations.

.2 Exposed trim: inside corners, outside corners, starter strip and trim of same material, colour and gloss as soffit, with fastener holes pre-punched.

2.2 WALL PANELS & EXPOSED TRIM

.1 Wall panels: 36" (914mm) coverage with 1.5" (38mm) deep major ribs at 6" (150mm) o/c. CL6025 as manufactured by VicWest Steel or UltraSpan as manufactured by Westman Steel, or approved equal in accordance with B7. Install vertical horizontal orientation.

.2 Fabricated from 24 gauge galvanized sheet steel, ASTM A653M, Grade 230 or higher, with Z275 zinc coating.

.3 Fabricated from 24 gauge galvalume sheet steel, ASTM A792M, Grade 230 or higher, with AZ150 or higher aluminum-zinc coating

.4 Finish: pre-painted with colours of proven durability for exterior exposure, Perspectra-Plus, WeatherXL, or approved equal paint system. Colour to be selected from manufacturer's standard range

.5 Exposed trim: inside corners, outside corners, starter strip and trim of same material, colour and gloss as wall panel.

2.3 FASTENERS

.1 Nails: to CSA B111, aluminum alloy, of type recommended by manufacturer, colour matched to soffit.

.2 Screws: Minimum #12 size, colour matched to wall panel, c/w integral neoprene washers.

2.4 CAULKING

.1 Sealants: in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install soffit in accordance with CAN/CGSB-93.5M, and manufacturer's written instructions.

.2 Install continuous starter strips, inside and outside corners, trim, and flashings.

.3 Maintain joints true to line, tight fitting, hairline joints.

.4 Attach components in manner not restricting thermal movement.

.5 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.6 Install soffit and fascia cladding as indicated.

.7 Caulk junctions with adjoining work with sealant.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Aluminum Association (AA).

.1 AA DAF-45, Designation System for Aluminum Finishes - 9th Edition.

.2 AA ASM-35, Specifications for Aluminum Sheet Metal Work in Building Construction, Section 5.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.5 ASTM B32, Standard Specification for Solder Metal.

.6 ASTM B370, Standard Specification for Copper Sheet and Strip for Building Construction.

.7 ASTM D523, Standard Test Method for Specular Gloss.

.8 ASTM D822, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-37.5, Cutback Asphalt Plastic Cement.

.2 CAN/CGSB-37.29, Rubber-Asphalt Sealing Compound.

.3 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.

.4 CAN/CGSB-93.1, Sheet Aluminum Alloy, Prefinished, Residential.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA A123.3, Asphalt Saturated Organic Roofing Felt.

.5 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC).

.1 CCMC, Registry of Product Evaluations.

1.2 SUBMITTALS

.1 Submit product data sheets.

.2 Submit shop drawings sealed by an Engineer registered in the Province of Manitoba indicating arrangements of sheets and joints, types and locations of fasteners and special

shapes and relationship of panels to structural frame, and anchorage details to the Contract Administrator for review prior fabrication and installation.

.3 Prefinished roof deck supplier to design connections to substructure for 2.0 kPa uplift, or as required by NBCC if greater.

.4 Roof system fabricator is responsible for complete design and engineering of snow/ice guard system for sheet metal roofing. Guards shall be finished to match roof panels.

1.3 QUALITY ASSURANCE

.1 Roofing Contractor must be a member in good standing with the Roofing Contractors Association of Manitoba.

.2 The contractor is responsible for ensuring that the design, supply and total installation of this project are supervised and executed by fully trained and qualified personnel.

.3 Installer shall demonstrate at least five years experience in projects similar in scope.

.4 The materials and installation shall meet the applicable standards of the National Building Code, Underwriters Laboratories of Canada (ULC), the Canadian Standards Association (CSA) and any other applicable codes, standards and by-laws.

.5 Written confirmation of conformance with these standards shall be provided to The City.

1.4 GUARANTEE

.1 Provide a written guarantee, signed and issued in the name of The City of Winnipeg stating that the entire roofing system is guaranteed against leaking for a period of two (2) years from the date of completion.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Marquis 450 roof panels as manufactured by VicWest Steel or approved equal in accordance with B7 .

.2 Snap-Loc roof panels with ribs at 16” (450mm o/c) as manufactured by Westman Steel or approved equal in accordance with B7.

.3 Roof panels:

.1 Fabricated from 24 gauge galvanized sheet steel, ASTM A653M, Grade 230 or higher, with Z275 zinc coating.

Fabricated from 24 gauge galvalume sheet steel, ASTM A792M, Grade 230 or higher, with AZ150 or higher aluminum-zinc coating.

.2 Finish: pre-painted with colours of proven durability for exterior exposure, Perspectra-Plus, WeatherXL, or approved equal paint system. Colour to be selected from manufacturer’s standard range.

.3 Colour sample to be approved by Contract Administrator.

.4 Metal flashings, trim, closures exposed to view: prefinished steel sheet of same gauge and finish as roof panels.

.5 Sheet metal accessory components not exposed to ground level view: galvanized steel sheet, minimum 24 gauge.

.6 Screws anchors: as recommended by roofing supplier. Use galvanized anchors, with length and size to meet roof system design.

.7 Deck closures: gauge and profile as recommended by manufacturer

2.2 WATERPROOF MEMBRANE

.1 Self-adhesive, modified bitumen sheet, minimum 1 mm (40 mils) thick, non-slip surface. Acceptable material: IKO Armour Gard Ice and Water Protector, W.R. Grace Ice and Water Shield; Domtar Eaveshield; Nordshield Water Stopper; Bakor Eave Guard; BPCO ProGard; EMCO Gripgard, or approved equal in accordance with B7.

2.3 FASCIA, GUTTERS AND DOWNSPOUTS

.1 Form fascia and trim of prefinished steel sheet of same material, thickness, and finish. Colour to be selected from manufacturer’s standard range.

.2 Form gutters and downspouts of prefinished steel sheet of same material, thickness, finish and colour as roof panels, conforming to sizes and profiles indicated. Seal joints against leakage. Colour to be selected from manufacturer’s standard range.

.3 Provide goosenecks, outlets and necessary fastenings.

.4 For open type downspouts where indicated, fabricate of prefinished steel sheet with same finish and colour on both sides of sheet. Colour to be selected from manufacturer’s standard range. Submit samples to Contract Administrator for review prior to ordering material

.5 Gutter hangers, purpose made, concealed type. Spikes and ferrules not permitted.

Part 3 Execution

3.1 WATERPROOF MEMBRANE INSTALLATION

.1 Install self-adhesive membrane in accordance with manufacturer's instructions.

.2 Roll out sheets and press firmly to substrate. As installation progresses roll with hand roller to ensure positive bond.

.3 Set first course along eaves. Overlap each succeeding course over lower. Side and end laps minimum 75 mm. Ensure full bond to roof deck and sealed at side and end laps. Avoid excessive bubbles and fish mouths.

.4 Flash and seal around openings and items penetrating roof deck. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal with mastic sealant. Make water tight.

3.2 METAL ROOFING INSTALLATION

.1 Install metal roofing system in strict accordance with reviewed shop drawings and manufacturer's instructions.

.2 Install factory manufactured panels in longest practical lengths with special panels to suit valleys and penetrations. Provide a continuous locked seam, mechanically locking the hold down clips into the seam.

.3 Design of roofing system to provide for differential movement between the new roofing system of the existing structure and the new roofing system of the addition.

.4 Provide notched and formed closures, to shed water, at changes in pitch and at peaks, ridges and eaves.

.5 Remove all drillings, filings, and cuttings immediately from roof as work progresses to prevent damage to installed panels and trims.

3.3 FIELD QUALITY CONTROL

.1 Inspection of roof application may be carried out by an independent agency selected by the Contract Administrator.

.2 Notify inspection agency minimum 48 hrs. prior to commencing roofing operations to arrange inspections. Permit agency full access to all portions of work.

.3 Note that the last inspection is to be a “final inspection”, carried out after all roofing is complete, including installation of equipment and openings, and shall be in the presence of the Contract Administrator and the Contractor.

3.4 TOUCH-UP AND CLEANING

.1 Touch up minor paint abrasions with touch-up paint provided by roof panel manufacturer to match colour of roof panels.

.2 Clean roof by dry-wiping.

.3 Leave job site completely clean.

END OF SECTION

Part 1 General

1.1 Work Included

.1 Prefinished Metal Caps, Transition, Drip, Gable, Valley, Eave and associated flashings.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-[07], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual [1997].

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-[M77], Sheathing, Membrane, Breather Type.

1.3 Existing Conditions/Protection

.1 Exercise care when working on or about roof surfaces to avoid damaging or puncturing membrane or flexible flashings.

.2 Place plywood panels on roof surfaces to Work of this section and access routes. Keep in place until completion of work.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.2 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and the Contract Administrator.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Store covered, off ground and handle by methods that prevent damage from twisting, bending and rubbing.

.3 Protect flashings and finish from impact and scraping. Cover surfaces susceptible to damage.

1.7 Job Conditions

.1 Prevent damage to adjoining wall surfaces and roofing.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: Minimum 24 gage, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

.2 Aluminum-Zinc coated steel sheet: Minimum 24 gage, commercial quality to ASTM A792/A792M, with AZ150 or higher designation zinc coating.

2.2 PREFINISHED STEEL SHEET

.1 Minimum 24 gage, commercial quality Sheet Metal Material (zinc or aluminum-zinc as above), pre-painted with colours of proven durability for exterior exposure, Perspectra-Plus, WeatherXL, or approved equal paint system. Colour to be selected from manufacturer’s standard range.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint. “Top services Thick Black” by Glidden

.2 Rubber –asphalt sealing compound : conforming to requirements of CGSB 37 – GP-5M.

.3 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.4 Fasteners: of same material as sheet metal, to CSA B111, ring thread/ flat head roofing nails of length and thickness suitable for metal flashing application.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Solder: to ASTM B32, alloy composition 50% Tin and 50% lead .

.7 Flux: Commercial quality as recommended by sheet metal manufacturer

.8 Underlay for Metal Flashing: No.15 asphalt felt in accordance with CSA A123.3-M.

.9 Touch-up paint: as recommended by prefinished material manufacturer.

.10 Joint Sealant : install joint sealant in accordance with Specification 079210

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details as indicated.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints with “S” lock seams maintaining a 22 mm lap on all joints .

.3 Hem exposed edges on underside 13 mm. Mitre and seal corners with sealant.

.4 Fabricate cap flashings to lap 100 mm over base flashings.

.5 All sections to be flat lock type except corners. Fabricate corners minimum 460 mm, mitred, soldered or welded as one piece.

.6 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.7 Provide gravel stops with 125 mm minimum deck flange and 110 mm minimum fascia.

.8 Form gum boxes from 0.71 mm galvanised steel with 75 mm minimum upstand and 100 mm one piece flanges. Solder joints. Make pans wider than member passing through roof membrane by 50 mm minimum on all sides.

.9 Supply splash pans from 0.71 mm galvanised steel.

.10 Fabricate roof scuppers from 0.71 mm pre-painted galvanised sheet steel with one piece deck flange 150 mm minimum. Contour scupper to cant strips.

.11 Backpaint flashing with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

Part 3 Execution

3.1 EXAMINATION

.1 A Prior to commencing installation, thoroughly examine other work upon which this Work is dependent. Report any deficiencies discovered, propose adjustments to the engineer and obtain written authorization before proceeding.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.2 Back-paint sheet metal with bituminous isolation coating on surfaces in contact with concrete, masonry cementitious materials or dissimilar metal.

.3 Set flashings in place not later than seven days after installation of the membrane on any particular section of the roof.

.4 Install flashings with maximum distances between joints of 1200 mm for parapet face flashings, 1200 mm for cap flashings, 300 mm wide or greater on the top surface, and 2400 mm for all other flashings.

.5 Insert metal flashings into reglets to form tight joint and caulk into reglet with sealant compound.

.6 Fasten flashings using 0.75 mm thick by 150 mm long anchor clips on the fascia face and screws or annular ringed nails on the opposite face.

.7 Fasten flashings up to 1200 mm in length with galvanised steel clips through the extended "S" locks and in addition at mid length for flashings over 1200 mm in length.

.8 Fit flashings together so that one end of each section is free to move in the joint.

.9 Locate flashing screws at 200 mm minimum above roof membrane.

.10 Fill gum boxes with plastic cement in two equal lifts and separate lifts with one ply of organic felt, precision cut to fit box.

.11 Apply two plys of organic felt stripping over flanges of gum box and extend down face of curb. Reinforce stripping with a 2 ply of woven glass cloth.

.12 Bed and secure in place 0.71 mm thick, 600 mm x 600 mm x 25 mm high lip, galvanised steel splash pans to roof with hot asphalt at end of downspouts spilling out on roof.

.13 Set gravel stop in place with nails on bed of plastic cement. Apply a strip of organic felt in plastic cement over gravel stop. Mop over a second strip of organic felt reinforced with 2-ply glass cloth.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

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

3.5 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

.1 The work included under this section shall conform to the definitions in the "Manitoba Trade Definitions" handbook produced by the Winnipeg Construction Association, and shall in general include the closure of all peripheral openings around conduits (pipe, duct or cabling) as well as fixtures and fittings installed in or through fire separations.

1.2 REFERENCE STANDARDS

.1 CAN/ULC S115 Standard Method of Fire Tests of Firestop Systems.

.2 CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.3 ULC Guide No. 40 U19 for Service Penetration Assemblies and Firestopping

.4 UL 555 – Standard for Safety: Fire Dampers

.5 NFPA 90A – Installation of Air Conditioning and Ventilating Systems

1.3 RELATED WORK

.1 Section 23 33 00 – Air Duct Accessories

.2 Section 23 31 13 – Metal Ducts – low pressure

.3 Section 23 38 18 – Thermoset Fiber Polymer Ductwork (low pressure) - FRP

1.4 SHOP DRAWINGS

.1 Submit product sheets for all materials in accordance with Section 01 33 00 –Submittal Procedures.

.2 Submit manufacturer technical product data, including description and installation instructions for each product to be used.

.3 Submit a fire stopping plan to U.L.C. numbered tested standards.

.4 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings, methods of installation. Construction details should accurately reflect actual job conditions.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended, in accordance with ULC Design Numbers.

.2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.

.3 Fire Dampers to be tested, rated, and labeled in accordance with UL 555.

.4 Fire dampers shall meet requirements for fire dampers in accordance with:

.1 NFPA 80, 90A and 101

.2 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.

.3 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.4 Fire stop sealant: one-part silicone elastomer.

.1 Acceptable products:

.1 3M Fire Barrier Silicone Sealant 2000 NS.

.2 AD Fire Protection Systems Inc. "A/D Firebarrier".

.3 Tremco "Fyre-Sil".

.4 Hilti FS ONE Max Firestop Sealant.

.5 Or approved equal in accordance with B7.

.5 Fire stop foam: two-part silicone elastomer, foaming, expanding.

.1 Acceptable products;

.1 3M Fire Barrier Silicone RTV Foam 2001.

.2 AD Fire Protection Systems Inc. "A/D Firebarrier RTV".

.3 Hilti CP 620 Fire Foam.

.4 Or approved equal in accordance with B7.

.6 Fire stop mortar: lightweight, cementitious.

.1 Acceptable products;

.1 3M Fire Barrier Mortar.

.2 AD Fire Protection Systems Inc. "A/D FIREBARRIER Mortar ".

.3 TREMstop Fire Mortar.

.4 Hilti CP 637 Firestop Mortar.

.5 Or approved equal in accordance with B7.

.7 Backup, damming material: preformed, semi-rigid, fire resistant, non-combustible, mineral wool, per requirements of manufacturer.

.8 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.9 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.10 Sealants for vertical joints: non-sagging.

PART 3 EXECUTION

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrate and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains or adjacent surfaces.

.5 Prime surfaces to receive fire stop material with manufacturer recommended primer.

3.2 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

.6 Install fire-stop material to obtain fire-resistance rating not less than the fire resistance rating of surrounding floor and wall assembly.

.7 Install fire stopping material appropriate to type of opening being sealed:

.1 Fire stop sealant at simple openings, single pipes, conduit, cables, etc.

.2 Fire stop foam at complex penetrations, multiple cables, pipes, conduit, etc.

3.3 INSPECTION

.1 Notify Engineer when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE OF LOCATIONS

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated gypsum board partitions and walls.

.2 Edge of floor slabs at curtain wall and precast concrete panels.

.3 Top of fire-resistance rated gypsum board partitions.

.4 Intersection of fire-resistance rated masonry and gypsum board partitions.

.5 Control and sway joints in fire-resistance rated gypsum board partitions and walls.

.6 Penetrations through fire-resistance rated floor slabs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts: greater than 129 cm^2 fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle

and duct, on both sides of the fire separation.

.2 Locations of special requirements for fire stopping and smoke seal materials at openings and penetrations in fire resistant rated assemblies are indicated on drawings.

3.5 CLEAN UP

.1 Remove excess materials and debris, clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of firestopping and smoke seal materials.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 22 05 05 - Selective Demolition for Plumbing

.2 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 919-19, 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 1481-12, 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 2240-15e1, Standard Test Methods for Rubber Property, Durometer Hardness

.9 ASTM D 2628-91, 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:

.1 Chemical Base
.2 Shelf Life
.3 Storage Conditions
.4 Volatile Organic Compound (VOC) Content
.5 Hardness
.6 Tensile Strength
.7 Elongation at Break
.8 Tensile Strength at Specified Length
.9 Movement Capability
.10 Service Temperature
.11 Cure Time
.12 Environmental, Health and Safety

.3 Submit one electronic copy of WHMIS SDS.

.3 Samples:

.1 Submit two samples of each type of joint sealant material and colour.

.2 Submit two cured samples of exposed sealants of each colour to match adjacent material.

.4 Certificates: When requested by Contract Administrator, submit manufacturer's product certificates indicating proposed sealant is appropriate for each application on this Project.

.5 Manufacturer's Instructions:

.1 Submit instructions for each type of product.

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 Minimum three years successful experience in Work of similar size and complexity.

.2 Compatibility: Ensure sealants are compatible with adjacent materials and are approved by manufacture for use with adjacent materials.

.3 Mock-Ups:

.1 Before performing sealant work do sample applications of each type of sealant for review.

.2 Site locations for sample applications shall be designated by Contract Administrator.

.3 Construct joint sealant mock-ups in assemblies of other Sections with joint sealants, which are referenced in this Section.

.4 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Health Canada.

1.6 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 Store and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 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.

.6 Divert unused joint sealing material from landfill to official hazardous material collections site approved by City.

1.7 SITE CONDITIONS

.1 Ambient Conditions

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 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 Ventilate area of work as directed by Contract Administrator by use of approved portable supply and exhaust fans.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

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

.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 SUSTAINABILITY CHARACTERISTICS

.1 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 VOC emissions limits shall be as follows:

.1 Sealant Primers:

.1 for non-porous surfaces: 250 g/L

.2 for porous surfaces: 775 g/L
.3 for modified bituminous membranes: 500 g/L
.4 for marine deck: 760 g/L
.5 for other conditions: 420 g/L

.2 Sealants:
.1 architectural: 250 g/L
.2 marine deck: 760 g/L
.3 non-membrane roof: 300 g/L
.4 roadway: 250 g/L
.5 single-ply roof membrane: 450 g/L
.6 other conditions: 420 g/L

2.2 PERFORMANCE REQUIREMENTS

.1 Each sealant system shall meet the following requirements for warranty period:

.1 Waterproof, flexible, and compatible with substrate under applicable service conditions.
.2 Provide a weather-tight seal that does not allow moisture penetration.
.3 Shall not de-bond, crack, or craze.
.4 Shall not leak.

2.3 SEALANT MATERIALS

.1 In air handling units and supply air system, use sealants without strong 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.

2.4 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-4: Silicone Sealant; structural glazing.

.1 To ASTM C 920: type S; grade NS; class 25; use NT, A, G, O.

.5 Type S-5: Acoustical Sealant; interior, non-skimming, non-hardening, simple component synthetic rubber sealant, to ASTM C 919.

.6 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.

.7 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.

.8 Type S-8: Horizontal joint sealant; two component, self-levelling.

.1 To ASTM C 920: type M; grade P; class 25; use T, M, O.

.9 Type S-9: One part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to ASTM C 920, type S, grade P, class 50, use T, M, A,O, MC-1-25-B-N.

.10 Type S-10: Control joint sealant: two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.

.11 Type S-11 Control Joint Sealant: Two component, polyurea based, load bearing, self levelling sealant.

.12 Type S-12 Control Joint Sealant: Two component, semi-rigid epoxy, load bearing, self levelling sealant.

.13 Type S-13: One-component polyurethane sealant; medium-modulus, non-sag, low-VOC, UV stable, to CAN/CGSB-19.24.

2.5 SEALANT SELECTION

.1 Where no specific type of sealant is scheduled, provide one of the sealants indicated in this Section appropriate for its application and consistent with manufacturer's recommendations.

.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 washrooms and kitchens. Do not use on floors.

.5 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type specified.

.6 Use structural glazing silicone Type S-4 for sealing glass, interior and exterior.

.7 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.

.8 Use multi component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.

.9 Use multi component sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.

.10 Use polyurethane, semi-self levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%.

.11 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.

.12 Use control joint sealant S-10 as filler for interior only, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.

.13 Use control joint sealant S-11 as filler for interior, horizontal saw cut or preformed control joints, where joints are subject to low temperatures (freezer floors) and where joints require nosing support.

.14 Use control joint sealant S-12 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to thermal shock conditions, traffic loops, and where a high bond strength is required.

.15 Use sealant S-13 for sealing exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.

2.6 ACCESSORIES

.1 Preformed compressible and non-compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing:

.1 Rod Type Sealant Backings:

.1 ASTM 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.

2.7 COLOURS

.1 Sealant Colours: Match colour of adjacent materials where visible, as selected by Contract Administrator, 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 Contract Administrator 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.

3.8 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 washrooms and 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 structural glazing silicone Type S-4 for sealing butt-to glazing joints, interior and exterior.

.5 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.

.6 Use multicomponent sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.

.7 Use multicomponent sealant type S-6, at perimeters of exterior openings where frames meet exterior facade of building (e.g., brick, block, precast masonry).

.8 Use multicomponent sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.

.9 Use sealant Type S-8 for exterior joints in horizontal wearing surfaces.

.10 Use polyurethane, semi-self-levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%.

.11 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.

.12 Use control joint sealant S-11 as filler for interior, horizontal saw cut or preformed control joints, where joints are subject to low temperatures (freezer room floors) and where joints require nosing support.

.13 Use control joint sealant S-12 as filler for interior, horizontal saw cut, or preformed control joints where joints are subject to thermal shock conditions, traffic loops, and where a high bond strength is required.

.14 Use sealant S-13 for exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.

.15 Use sealant S-16 in pavement wherever fuel oils may be present

.16 In addition, provide joint sealants at the following conditions:

.17 Seal perimeters of hollow metal door frames on both sides.

.18 Seal control joints in gypsum board, except where prefabricated control joints are specified.

.19 Seal junctures between interior partitions with exterior walls.

.20 Seal window and door frames around the inside perimeter, so that an airtight seal is obtained, as indicated on Drawings.

.21 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.

.22 Perimeter of bath fixtures (e.g., sinks, tubs, urinals, water closets, basins, vanities).

.23 Expansion and control joints in exterior surfaces of poured-in-place concrete walls.

.24 Expansion and control joints in exterior surfaces of precast architectural wall panels.

.25 Movement, control and expansion joints in exterior surfaces of unit masonry walls.

.26 Coping joints and coping-to facade joints.

.27 Cornice and wash (or horizontal surface joints).

.28 Seal interior perimeters of exterior openings as detailed on Drawings.

.29 Control and expansion joints on the interior of exterior cast-in place concrete walls.

.30 Expansion and control joints on the interior of exterior precast, architectural wall panels.

.31 Joints of underside of precast beams or planks.

.32 Movement, control and expansion joints on the interior of exterior surfaces of unit masonry walls.

.33 Interior control and expansion joints in floor surfaces.

.34 Perimeters of interior frames, as detailed.

.35 Movement, control and expansion joints in exterior surfaces of unit masonry walls.

.36 Joints at tops of non-load bearing masonry walls at the underside of poured concrete.

.37 Exposed interior control joints in gypsum board.

.38 Seal at all locations where dissimilar material meet.

.39 Refer to Section 07 84 00 - Fire Stopping for additional requirements.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing (incorporating Amendment No. 1).

.2 CAN/CGSB-19.13, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.4 CAN/CGSB-19.17, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24, Multi-component, Chemical Curing Sealing Compound.

.6 CAN/CGSB-19.21 Sealing and Bedding Compound, Acoustical

.3 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

1.2 SUBMITTALS

.1 Submit product data.

.2 Manufacturer's product to describe.

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit manufacturer's instructions.

.1 Instructions to include installation instructions for each product used.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with the manufacturer’s written instructions.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

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1.4 ENVIRONMENTAL CONDITIONS

.1 Environmental Limitations:

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

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 5 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

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

.3 Joint-Substrate Conditions:

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

.4 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.5 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Type 1 – Silicones One Part: to CAN/CGSB-19.13. Acceptable material: Dow Corning 795, GE Silpruf, Tremco Spectrum 2.

.2 Type 2 – Silicones One Part: to CAN/CGSB-19.22-M89 (Mildew resistant). Acceptable material: Dow Corning 786.

.3 Type 3 – Acrylic Latex One Part: to CGSB 19-GP-5M. Acceptable material: Tremco 100 Latex Caulk, GE Acrylasil Latex Caulk.

.4 Type 4 – Butyl: to CGSB 19-GP-14M. Acceptable material: Tremco Butyl Sealant

.5 Type 5 – Rubber/Synth Rubber: To CGSB 19.24. Acceptable material: Tremco Acoustical/Curtainwall Sealant, LePage PL Acousti-seal

2.2 ACCESSORIES

.1 Preformed Compressible and Non-Compressible back-up materials.

.1 High-Density Foam. 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 density, or neoprene foam backer, size as recommended by manufacturer.

.2 Bond Breaker Tape. Polyethylene bond breaker tape that will not bond to sealant.

.2 Joint cleaner: non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.3 Primer: as recommended by manufacturer.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building: Sealant Type 1.

.2 Miscellaneous flashing joints and metal cladding: Sealant Type 1.

.3 Perimeter of washroom fixtures (e.g., sinks, urinals, water closets, vanities, etc.): Sealant Type 2.

.4 Interior paintable joints: Sealant Type 3.

.5 Bedding aluminum doorsills: Sealant Type 4.

2.4 JOINT CLEANER

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

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

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

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

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.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

.1 Sealant.

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

.2 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.
.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.
.2 Remove excess and droppings, using recommended cleaners as work progresses.
.3 Remove masking tape after initial set of sealant.

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END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B29, Specification for Refined Lead.

.3 ASTM B749, Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19M, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

.1 G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association, (CSDMA).

.1 CSDMA, Specifications for Commercial Steel Doors and Frames.

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80, Standard for Fire Doors and Fire Windows.

.2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN4-S104, Fire Tests of Door Assemblies.

.2 CAN4-S105, Fire Door Frames Meeting the Performance Required by CAN4-S104.

.7 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.8 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings.

.9 CAN/ULC-S704, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

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.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M for ratings specified or indicated.

1.3 SHOP DRAWINGS

.1 Submit shop drawings sealed by an engineer registered in the Province of Manitoba clearly indicating each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware, fire rating and finishes.

Part 2 Products

2.1 MATERIALS

.1 Fabrication Standards Fabricate doors and frames to Canadian Manufacturing Specification for Steel Doors and Frames, except where specified otherwise.

.2 Steel: Commercial grade steel to ASTM A568-81, Class 1, hot-dip galvanized to ASTM A527-80.

2.2 DOOR CONSTRUCTION

.1 Insulated core, welded seam: For exterior use. Reinforced construction. Provide urethane foam insulated cores to R.S.I. of 1.76 (R=10). Laminated by adhesive to face sheets. Reinforced for hardware.

.2 Component part thickness: 1.2 mm (18 gauge).

2.3 FRAME CONSTRUCTION

.1 Mitred or mechanically jointed and continuously welded on the inside of the profile. Welded joints to be ground to a smooth uniform finish.

.2 Component part thickness: 1.6 mm (16 gauge).

.3 Butt joints of mullions and transoms: accurately cope, securely weld and grind smooth.

.4 Blank, reinforce, drill and tap for mortised butts and strike. Protect cut-outs in masonry and concrete with mortar guard boxes. Reinforce for surface mounted hardware. Prepare each door for rubber bumpers, two for double door openings.

.5 Top hinge reinforcement: weld in top hinge reinforcement with 20mm leg to hinge reinforcement, 25mm to frame.

.6 Insulation: provide foam-in insulation in all exterior frame cavities.

2.4 DOOR HARDWARE

.1 Hinges CB1960 114 x 102 NRP 630 Stanley

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.2 Passage Set D10S 626 Schlage

.3 Deadbolt B860 626 Schlage (tamperproof "Medeco" cylinder – keyed to match City requirements).

.4 Flushbolts FB6 626 Glynn Johnson

.5 Weatherstrip 770C Reese

.6 Sweep Seals 773C Reese

.7 Astragal 275C Reese

.8 Threshold S205A Reese

.9 Door Stop/Holder F26 626 Glynn Johnson

2.5 FRAME ANCHORS

.1 Frames for installation shall be provided with minimum four steel anchors of suitable design.

2.6 KEYING

.1 Keys to match The City's existing "Medeco" system. The City to provide lock number before keying.

.2 Provide The City with keys in triplicate for every lock.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.2 DOOR INSTALLATION

.1 Install doors and hardware in accordance with templates and manufacturer's instructions.

.2 Adjust operable parts for correct function.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation. Secure anchorages and connections to adjacent construction.

.2 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support

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at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in. Make allowances for deflection of structure to ensure structural loads are not transmitted to frames

.3 Caulk perimeter of frames between frame and adjacent material.

.4 Maintain continuity of air barrier and vapour retarder.

3.4 FINISH

.1 Paint doors and frames in accordance with Section 09 91 23 - Painting in colour approved by Contract Administrator.

3.5 FINISH REPAIRS

.1 Touch up finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual.

.5 National Fire Code of Canada

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), c. 34 .

1.2 SCOPE OF WORK

.1 The scope of work includes, but is not limited to:

.1 Paint all new interior walls

.2 All interior piping shall be painted in accordance with this specification.

.3 Any new metal surfaces, not already factory finished, shall be painted in accordance with this specification. Touch up any equipment factory painted, including equipment supplied by the City.

.4 Existing structural steel shall be painted in accordance with this specification as indicated in the drawings

.5 All concrete repairs, patching and new concrete shall be painted in accordance with this specification.

.6 Paint all existing concrete walls and surfaces as shown in the Specifications and Drawings.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Provide color samples to the Contract Administrator for approval before application.

.3 Submit product data for the use and application of paint thinner.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation and application instructions.

.6 Extra Materials:

.1 Submit one 4-litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.2 Deliver to the City of Winnipeg and store where directed.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly.

.7 Remove paint materials from storage only in quantities required for same day use.

1.5 ENVIRONMENTAL REQUIREMENTS

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

.2 Ventilation: ventilate area of work by use of approved portable supply and exhaust fans.

.3 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.

.4 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

.5 Apply paint only when surface to be painted is dry, properly cured, and adequately prepared.

Part 2 Products

2.1 MATERIALS

.1 Only paint materials listed in the MPI Approved Products List (APL) are acceptable for use on the project, except where other products are specified.

.2 Paint materials for each coating formula to be products of a single manufacturer.

.3 Colour schedule will be determined by the Contract Administrator. Selection of colours will be from manufacturer's full range of colours.

.4 Paint Finishes: Except for Formula 1 (epoxy) use Master Painters Institute (MPI) finishing formulae as specified below:

.1 Formula 1: for wood to receive paint finish: MPI EXT 6.4B - Alkyd GR (semi-gloss) finish premium grade.

.2 Formula 2: for shop primed and unprimed ferrous metal surfaces (Alkyd):

.1 MPI EXT 5.1D Alkyd G5 (semi-gloss) finish premium grade.

.2 Touch-up shop primer (if used) with primer provided by the manufacturer.

.3 One coat marine alykd metal primer CGSB-1-GP-48M.

.4 Two coats semi-gloss enamel CAN/CGSB-1.57.

.5 Acceptable products: Pratt and Lambert, Benjamin Moore, Glidden, Cloverdale or Northern Paint.

.6 Provide color samples to the Contract Administrator for approval before application.

.7 Paint and primer shall be from the same manufacturer.

.3 Formula 3: for galvanized and zinc-coated metal: MPI EXT 5.3B - Alkyd G5 (semi-gloss) finish premium grade.

.4 Formula 4: for concrete, walls and ceilings apply: MPI EXT 3.1A - Latex G5 (semi-gloss) finish premium grade.

.1 One coat latex primer-sealer CAN/CGSB-1.119.

.2 Two coats semi-gloss enamel CAN/CGSB-1.57.

.3 Acceptable products: Pratt and Lambert, Benjamin Moore, Glidden, Cloverdale or Northern Paint.

.4 Paint and primer shall be from the same manufacturer.

.5 Formula 5: for concrete floors apply: MPI EXT 3.2D – Alkyd floor enamel #59 low gloss finish premium grade. Sprinkle with clean silica sand to provide slip-resistant surface acceptable to Contract Administrator.

2.2 EXTRA MATERIALS

.1 Submit one 4-litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.2 Deliver to City and store as directed.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to the Contract Administrator.

.2 Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.4 PREPARATION

.1 Protection:

.1 Cover or mask floors, walls, and equipment adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

.2 Protect items that are permanently attached such as Fire Labels on doors, frames, and name plates on equipment.

.2 Surface Preparation: Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.4 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

3.5 APPLICATION

.1 Apply paint in accordance with manufacturer's application instructions unless specified otherwise.

.2 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.3 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.4 Sand and dust between each coat to remove visible defects.

.5 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

.6 Do not paint over galvanized metal, aluminium, stainless steel, brass or bronze, rubber, plated surfaces, machined surfaces, hangers and nameplates.

.7 Ventilate area of work by use of approved portable supply and exhaust fans.

.8 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.

.9 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

.10 Apply paint only when surface to be painted is dry, properly cured, and adequately prepared.

.11 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.12 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.13 Sand and dust between each coat to remove visible defects.

.14 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.15 Paint both sides and edges of backboards for electrical equipment before installation. Leave equipment in original finish except for touch-up as required.

3.6 CLEANUP

.1 Clean and reinstall all hardware items that were removed before undertaken coating operations.

.2 Remove over-spray, paint splatter and spills from exposed surfaces that were not intended for painting. Remove smears and spatter immediately as operations progress, using appropriate methods as per manufacturer's instructions.

3.7 PUMPS

.1 Do not apply primer or paint to pumps.

3.8 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Do not paint exposed conduit, ductwork and hangers, unless otherwise indicated.

.2 Paint exposed piping. Colour and texture to match adjacent surfaces, except as noted otherwise.

.3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.4 Do not paint over nameplates, brass or bronze surfaces or machined surfaces.

.5 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashes on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of the Contract Administrator. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by the Contract Administrator.

3.10 STANDARDS OF ACCEPTANCE

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface when viewed using final lighting source.

.2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Piping, valves and pumping equipment: No visible defects from a distance of 1000 millimetres at 90 degrees to surface when viewed using final lighting source.

.4 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

END OF SECTION

PART 1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets including product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.5 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.6 As-built drawings:

.1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.2 Submit to Contract Administrator for approval and make corrections as directed.

.3 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 QUALIFICATIONS

.1 Work to be installed by qualified workmen who are fully familiar with this work and have a working knowledge of the systems components.

.2 Contractor to be fully familiar with governing regulations having jurisdiction on this project.

1.6 PLUMBING CODES

.1 Work to be installed in accordance with local code requirements except where more stringent requirements are specified under this section.

.2 Where local code requirements are at variance with this section of specification, the work to be installed in accordance with the local code requirements at no additional cost to this Contract.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for selective demolition and removal of plumbing, and related mechanical components and incidentals required to complete work described in this Section.

1.2 RELATED REQUIREMENTS

.1 Section 02 41 00.08 - Demolition - Minor Works

.2 Section 01 35 43 - Environmental Procedures

.3 Section 02 82 00.02 - Asbestos Abatement - Intermediate Precautions

.4 Section 07 84 00 – Fire Stopping.

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of existing construction taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to City ready for reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA S350 M1980, Code of Practice for Safety in Demolition of Structures.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide the following in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section:

.1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 11 – Cleaning.

.2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work of this Section in accordance with the following:

.1 Provincial/Territorial Workers' Compensation Boards/Commissions

.2 Provincial/Territorial Occupational Health and Safety Standards and Programs

1.8 SITE CONDITIONS

.1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.

.2 Existing Hazardous Substances: Contract Administrator has performed a hazardous substances assessment and identified materials requiring abatement as follows:

.1 Hazardous substances are as defined in the Hazardous Products Act.

.2 Hazardous Asbestos substances will be handled as covered in Section 02 82 00.02 - Asbestos Abatement - Intermediate Precautions.

.3 Hazardous substances will be removed by the Contractor as a part of the Contract before starting Work in accordance with work results described in Related Requirements listed above.

.3 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in the Work, other than those noted in 1.8.2; immediately notify Contract Administrator if materials suspected of containing hazardous substances not noted in noted in 1.8.2 are encountered and perform the following activities:

.1 Hazardous substances will be as defined in the Hazardous Products Act.

.2 Stop work in the area of the suspected hazardous substances.

.3 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.

.4 Hazardous substances will be removed by Contractor under a separate contract or as a change to the Work.

.5 Proceed only after written instructions have been received from Contract Administrator.

1.9 SALVAGE AND DEBRIS MATERIALS

.1 Demolished items become Contractor's property and will be removed from Project site.

Part 2 Products

2.1 MATERIALS

.1 General Patching and Repair Materials: Refer to Section 02 41 00.08 - Demolition - Minor Works for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.

.2 Plumbing Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction

.3 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance as per Section 07 84 00 – Fire Stopping.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; The City will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

3.2 PREPARATION

.1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

.1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.

.2 Notify Contract Administrator and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

.3 Prevent debris from blocking drainage inlets.

.4 Protect mechanical systems that must remain in operation.

.2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the City and users is minimized and as follows:

.1 Prevent debris from endangering the safe access to and egress from occupied buildings.

.2 Notify Contract Administrator and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

.1 Demolition and Removal: Coordinate requirements of this Section with information contained in Section 02 41 00.08 - Demolition - Minor Works and as follows:

.1 Disconnect and cap mechanical services in accordance with requirements of local Authority Having Jurisdiction.

.2 Do not disrupt active or energized utilities without approval of the City.

.3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.

.4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.

.5 At end of each day's work, leave worksite in safe condition.

.6 Perform demolition work in a neat and workmanlike manner:

.1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

3.4 CLOSEOUT ACTIVITIES

.1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

.2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances in accordance with requirements of Section 02 82 00.02 - Asbestos Abatement - Intermediate Precautions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Water Works Association (AWWA).

.1 AWWA C511-07, Reduced-Pressure Principle Backflow Prevention Assembly.

.2 National Plumbing Code of Canada

.1 American Society for Testing and Materials (ASTM)

.1 ASTM B 62

.2 ASTM A 126

.2 ASSE Standard 1010.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 FLOOR DRAINS

.1 3” drainage pipe connection

.2 Nickle Bronze or Stainless Steel drainage cover.

.3 Gas tight plug to be included.

.4 Load rating as per ASME – MD.

2.2 WATER HAMMER ARRESTORS

.1 Arrestors: ASSE Standard 1010.

.2 Arrestor body: bronze.

.3 End connections: threaded, NPT.

.4 Maximum working pressure: 10.3 bar.

.5 Temperature range: 0.6 to 82°C.

.6 Preloaded Air Pressure: 4.1 bar

.7 Locate arrestor as close to water use source as possible. Locate arrestor such that source of water shock is directed into arrestor body.

.8 Acceptable material: Watts or approved equal in accordance with B7.

2.3 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

.2 Seals material: EPDM.

.3 Maximum pressure rating 8.6 bar.

.4 Minimum supply pressure 172 kPa.

.5 Minimum flow 6.1 LPM.

.6 Must meet CSA-B64 Series.

.7 Acceptable material: Watts or approved equal in accordance with B7.

2.4 PRESSURE REGULATORS

.1 Capacity:

.1 Inlet pressure: 1034 kPa.

.2 Outlet pressure: 413 kPa.

.2 Up to NPS 1-1/2 bronze bodies, screwed: to ASTM B 62

.3 NPS 2 and over, semi-steel bodies, Class 125, flanged: to ASTM A 126, Class B.

.4 Semi-steel spring chambers with bronze trim.

2.5 MESH Y-STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, stainless steel removable screen.

.2 NPS2 and under, bronze body, screwed ends, with brass cap.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with the National Plumbing Code of Canada and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Contract Administrator. Do not connect to tepid water lines.

.3 Install as per manufacturers installation documentation.

.4 Install soft copper piping to floor drain or drainage piping as indicated.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.5 BACK FLOW PREVENTORS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain or as indicated.

3.6 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.7 STRAINERS

.1 Install with sufficient room to remove basket.

3.8 START-UP

.1 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.2 Provide continuous supervision during start-up.

3.9 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Manufacturer Requirements, supplemented as specified by Contract Administrator.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.

.4 Floor drains:

.1 Verify operation of trap seal primer.
.2 Prime, using trap primer. Adjust flow rate to suit site conditions.
.3 Check operations of flushing features.
.4 Check security, accessibility, removability of strainer.
.5 Clean out baskets.

.5 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.6 Hose bibbs, sediment faucets:

.1 Verify that flow and pressure meet design criteria.
.2 Check for leaks, replace compression washer if required.

.7 Strainers:

.1 Clean out repeatedly until clear.
.2 Verify accessibility of cleanout plug and basket.
.3 Verify that cleanout plug does not leak.

3.10 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Contract Administrator requirements.

3.11 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.12 PROTECTION

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

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for copper domestic water service used in the following:

.1 PVC piping for domestic water services and seal water piping inside building.

.2 Sustainable requirements for construction, verification and operation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 22 05 15 - Plumbing Specialties and Accessories

.3 Section 23 05 00 - Common Work Results - Mechanical

.4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).

.1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).

.3 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.3 American Water Works Association (AWWA).

.1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.
.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction.

.1 NRCC 38728, National Plumbing Code of Canada (NPC).

.9 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.4 SUBMITTALS

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

Part 2 Products

2.1 PVC PIPING

.1 General:

.1 Piping, fittings, flanges, flange gaskets, primer, cement to be product of one manufacturer.
.2 Equipment manufacturers as listed or approved equal in accordance with B7.

.2 Piping: to CSA-B137 and ASTM D1784.

.1 Schedule 80.
.2 To be smooth and free from imperfections.

.3 Fittings:

.1 Pressure rating: same as for pipes.
.2 NPS 1/2 to 4: solvent welded type.
.3 NPS 6 and over: solvent welded type.
.4 Solvent Welded Fittings: to ASTM D2467, solvent welded type, from PVC, compatible with piping.
.5 Field fabricated fittings: not permitted.

.4 Provisions for Pipe Movement:

.1 Offsets: locations, shapes, dimensions to be as indicated.

.5 Flanged Joints:

.1 Flanges: PVC, Vanstone style, conforming dimensionally to ANSI/ASME B16.1, for 1,355 kPa: slip-on full faced, solvent welded to pipe.
.2 Gaskets: EPDM Gaskets for glycol service, 3 mm thick.

.3 Bolts and nuts: to ASTM A307, Grade B, ANSI B18.2.1, ANSI B18.2.2: stud bolts, carbon steel, semi-finished with heavy hex nuts, complete with washers.

.6 Valves:

.1 Ball valves:

.1 100 mm and under – PVC, PTFE ball seals with EPDM, socket ends, vented freeze protection. Chemline Type 21 or approved equal in accordance with B7.

.2 150 mm - Lug style, PVC butterfly valve and disc, EPDM seat and seals, 403 stainless steel shaft, plastic handle. Chemline Type 57LIS or approved equal in accordance with B7.

.3 200mm - Lug style, PVC butterfly valve and disc, EPDM seat and seals, 403 stainless steel shaft, gear operated actuator. Chemline Type 57LIS or approved equal in accordance with B7.

.4 Up to NPS 2: socket weld ends.

.5 NPS 2 1/2 and over: flanged ends.

.2 Spring (silent) check valves:

.1 50 mm and under - True union, full port, PVC ball check, EPDM seals, socket ends. Chemline BT or approved equal in accordance with B7.

.2 65 mm to 100 mm - Single union, full port, PVC ball check, EPDM seals, socket ends. Maximum working pressure 690 kPa at 50°C. Chemline BC or approved equal in accordance with B7.

.3 150 mm to 200 mm - Wafer style, PVC body, spacer and disc, 316 stainless steel, EPDM seals. Maximum working pressure 760 kPa for 150 mm and 600 kPa for 200 mm at 40°C. Chemline WP or approved equal in accordance with B7.

.4 Up to NPS 2: socket weld ends.

.5 NPS 2 1/2 and over: flanged ends.

.7 Strainers: PVC, Y-type, having full port full flow openings with hex cap and fluoroelastomer 0-ring cap seal.

.1 Screens: Type 316 stainless steel with 40 mesh stainless steel wire cloth.

.2 Pressure rating: 1035 kPa.

.3 For PVC piping systems under NPS 4, use Chemline Y-Strainer or approved equal in accordance with B7.

2.2 PIPING

.1 Domestic water piping systems within building.

.1 Above ground: copper tube, hard drawn, type K to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.3 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 2 and larger: roll grooved to CSA B242.

2.4 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.5 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.

.2 NPS 2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc

2.6 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.

2.7 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat

2.8 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and BunaN seat, steel lever handle

.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 BunaN seat, steel lever handle, with NPT to copper adaptors

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with NPC and local authority having jurisdiction.

.2 Install pipe work as shown on the drawings and as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with gate or ball valves as shown on the drawings or as directed by the Contract Administrator.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 00 - Common Work Results for HVAC

.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 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Provincial potable water guidelines. Let system flush for additional 2 h, 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 as required to achieve conformance to Provincial potable water guidelines.

.2 Upon completion, provide laboratory test reports on water quality for Contract Administrator approval.

3.7 START-UP

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.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 Monitor piping systems for freedom of movement, pipe expansion as designed.

.4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Verify compliance with safety and health requirements.

.4 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.3 Reports:

.1 Include certificate of water flow and pressure tests conducted on incoming water.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D 2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D 2564, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

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

.1 Safety Data Sheets (SDS).

.3 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

1.3 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 MATERIAL

.1 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

2.2 PIPING AND FITTINGS

.1 For piping to:

.1 CAN/CSA B1800

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D 2564

.2 Solvent weld for ABS: to ASTM D 2235

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code

3.3 TESTING

.1 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.
.2 Open, cover with linseed oil and re-seal.
.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.
.2 Ensure weirs are correctly sized and installed correctly.
.3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

PART 1 ENERAL

1.1 RELATED SECTIONS

.1 Section 22 05 15 – Plumbing Specialties and Accessories

.2 Section 22 11 18 – Domestic Water Piping

.3 Section 22 45 33.02 – Combination Emergency Fixtures

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/CSA Group (ANSI/CSA)

.1 ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.

.2 ANSI Z21.10.1A-2006 /CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.

.3 ANSI Z21.10.1b-2006 /CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.

.4 ANSI Z21.10.3A-2007 /CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

.5 ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

.2 CSA Group (CSA)

.1 CSA B51-03 (R2007), Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CAN/CSA C22.2 No.110-94 (R2004), Construction and Test of Electric Storage Tank Water Heaters.

.3 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

1.6 WARRANTY

.1 For the Work of this Section, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.

.2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

PART 2 PRODUCTS

2.1 ELECTRIC TANKLESS LIGHT INDUSTRIAL WATER HEATER

.1 Tankless water heater must have water connections on the bottom and be constructed with NSF 61 listed materials.

.2 Direct heating element to be non-ferrous, cartridge style, designed for field replacement.

.3 Tankless water heater to utilize a dual PID algorithm, actively managing power application to real-time system demand.

.4 Integrated flow meter capable of volumes in excess of 30 GPM drives predictive control algorithm.

.5 Water heater must be protected by redundant safeties. Redundant safeties to include thermo mechanical safety switches, infrared element monitoring via thermo optical sensors, and dual temperature monitoring via master control board.

.6 Tankless water heater user interface must have the following capabilities:

.1 Selectable display including Celsius/Fahrenheit, inlet temperature, outlet temperature, flow rate, and setpoint temperature.

.2 Capable of displaying flow rate in gallons per minute or liters per minute.

.3 Diagnostic features to include error and fault code display.

.4 Control board must maintain error/fault history of 9 events.

.5 Capable of factory coded temperature setting (max. and min.)

.6 Capable of firmware upgrades via USB port

.7 Capable of BMS integration

.8 Compliant with ANSI tepid water without additional mixing or purge features (inlet temperatures must not exceed 100°F)

.9 Approved Products: EEMAX AP102600 EFD or Approved Equal as per B7.

2.2 WATER HEATER ACCESSORIES

.1 Water heater accessories must follow Section 22 05 15. Provide electric tankless water heater system including the following system accessories:

.1 Pressure and Temperature Relief Valves: Stainless steel, ASME rated and stamped pressure relief valve. Adjust to pressure setting less than water heater working-pressure rating.

.1 Pressure and Temperature Safety Relief Valve set to 80 psig.

.2 Pressure-Reducing Valves.

.3 Pressure Gauge.

.4 Thread Adapters: NPT to BSPP, stainless steel.

.5 Y-Strainer: Stainless steel.

.6 Water Hammer Arrestor.

.7 Tee Fittings with Drain.

.8 Non-fused disconnect.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations. Installation shall meet the requirements in Section 22 07 19, and Section 22 11 16.

.2 Maintain manufacturer's recommended clearance and access dimensions.

.3 Provide structural steel for instantaneous heaters.

.4 Provide insulation between tank and supports.

.5 Install water supply piping to each water heater, and from heater to fixture requiring hot water supply connection.

.1 Install stop valves on water supply and outlet piping. Provide stop valve on each supply in readily-serviced location. Lock stop valve in OPEN position.

.6 If shipped loose, install pressure and temperature safety relief valves on water heater. Manifold relief valve discharge as shown in manufacturer's written instructions.

.7 Extend relief-valve outlet line, and discharge by positive air gap above closest floor drain.

.8 Install relief valve drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping.

.9 Run relief valve drain piping without creating tripping hazard.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Test and adjust installation.

.1 Set field-adjustable temperature set point of temperature-actuated controls. Adjust set point within allowable temperature range.

.2 Replace defective or malfunctioning controls and equipment.

3.4 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 An indoor emergency showers:

.1 Combination emergency shower and eye/face wash units.

1.2 RELATED SECTIONS

.1 Section 22 11 18 - Domestic Water Piping

.2 Section 22 13 16.16 - Sanitary Waste and Vent Piping – Plastic.

1.3 REFERENCES

.1 American National Standards Institute (ANSI):

.1 ANSI Z358.1 – American National Standard for Emergency Eyewash and Shower Equipment.

.2 ASTM International (ASTM):

.1 ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 CSA International (CSA):

.1 CSA Certified Product Listings for Industrial Control Equipment – Miscellaneous Apparatus – For Hazardous Locations.

.4 National Electrical Manufacturers Association (NEMA):

.1 NEMA Standards Publication 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

.5 National Fire Protection Association (NFPA):

.1 NFPA 70 – National Electrical Code.

.6 Underwriters Laboratories (UL):

.1 UL 94 - Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing.

1.4 SUBMITTALS

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

.2 Shop drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Points of operation on performance curves.

.3 Manufacturer to certify current model production.

.4 Certification of compliance to applicable codes.

.4 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, Contract Administrator before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Operation instruction for systems and component.

.4 Description of actions to be taken in event of equipment failure.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 3 copies of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.

.2 Make changes as required and re-submit as directed by Contract Administrator.

.7 As-built drawings:

.1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.2 Submit to Contract Administrator for approval and make corrections as directed.

.3 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.8 Submit copies of as-built drawings for inclusion in final TAB report.

1.5 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

.1 Source Limitations: Obtain emergency shower enclosures through a single source from a single manufacturer.

.2 Electrical Components: Listed and labeled per NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

.3 ANSI Standard: Comply with ANSI Z358.1.

.4 NSF Standard: Comply with NSF 61 for fixture components in contact with potable water.

Part 2 Products

2.1 MATERIALS

.1 Basis-of-Design Product: Subject to compliance with requirements, provide emergency shower enclosures manufactured by The Bradley Corporation or approved equal as per B7.

2.2 INDOOR EMERGENCY SHOWERS

.1 Description: Emergency showers provide a facility for quick drenching or flushing of the eyes and body for immediate emergency use.

.2 Hazardous Area Classification: D2 (Class 1, Division 2, Groups C; D).

.3 Plumbed Emergency Shower with Eye-Face Wash Combination Unit: ANSI Z358.1, self draining, factory-assembled and tested, with standard-compliant identification sign and inspection tag.

.4 Showerhead:

.1 Flow Rate: (minimum) 1.26 L/s at 207 kPa (20 gpm at 30 psi) flow rate.

.2 Shower Ball Valve: NPS 1-inch (DN 25), stay-open, activated with stainless steel pull rod.

.5 Eye/Face Wash:

.1 Flow Rate: 5.1 gpm (19.1 L/m).

.2 Eyepiece Dust Covers: Plastic eyewash cover.

.3 Eyewash Ball Valve: NPS 1/2-inch (DN 15) eyewash valve stay-open, activated with hand-activated push handle.

.6 Pipe and Fittings:

.1 Water Inlet: NPS 1-1/4-inch (DN 32) diameter, stainless steel.

.7 Flow switch to be included to facilitate flow alarm from both drench shower and eye wash to PLC.

Part 3 Execution

3.1 INSTALLATION

.1 Provide connections to fixtures and associated fittings in accordance with manufacturer's instructions.

.2 Install plumbed connection from unit waste outlet to waste system

.3 Install unit level, plumb, and anchored firmly in place in accordance with manufacturer's rough in drawings.

.4 Install water supply piping to each fixture requiring water supply connection. Provide lock-on stop on each supply in readily-serviced location.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 CLEANING

.1 Clean interior and exterior of all systems. Vacuum interior of ductwork, fan, and filter.

3.4 DEMONSTRATION

.1 Contract Administrator 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.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Points of operation on performance curves.
- .3 Manufacturer to certify current model production.
- .4 Certification of compliance to applicable codes.

.4 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, Contract Administrator before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Operation instruction for systems and component.
  - .4 Description of actions to be taken in event of equipment failure.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 3 copies of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.
  - .2 Make changes as required and re-submit as directed by Contract Administrator.
- .7 As-built drawings:
  - .1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS

BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.2 Submit to Contract Administrator for approval and make corrections as directed.

.3 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.8 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Not Applicable.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems. Vacuum interior of ductwork, fan, and filter.

3.3 DEMONSTRATION

.1 Contract Administrator 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.

3.4 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Contract Administrators (ASME)

.1 ASME B31.1-2018, Power Piping.

.2 ASTM International (ASTM)

.1 ASTM A125-1996(2018), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-2014, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-2015, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

.5 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.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.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 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 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58. ANSI B31.1 and SMACNA.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.3 General: all supports to have large load bearing surfaces and be as approved by pipe/duct manufacturer.

.4 Supports: adjustable clevis hangers sized to suit the O.D. of the pipe.

.5 Pipe hangers and trapeze hangers: supported by mild steel rod of the correct diameter to suit the hanger, as recommended by the steel manufacturer.

2.3 PIPE HANGERS

.1 Lower attachment - (Grinnell ref. numbers unless otherwise noted).

Pipe Material	Pipe Size	Hanger
All piping other than copper (bare pipe)	up to 50 mm (2")	Fig. 65
	65 mm (2-1/2") & over	Fig. 260
All piping other than copper (insulated)	up to 50 mm (2")	Fig. 65 with Fig. 160 (or to match insulation)
	65 mm (2-1/2") & over	Fig. 260 with Fig. 161 (or to match insulation)
Copper	all sizes	Fig. CT65

.2 Intermediate attachment - Fig. 140 threaded rod or Fig. 248 eye rod.

.3 Upper Attachment:

Structure	Attachment
Steel beams bottom clamp	Fig. 229 beam clamp with extension piece
Steel beams top clamp	Fig. 227 beam clamp
Steel joists top clamp	Fig. 61 wide throat C-clamp
Concrete	Fig. 285 [up to 181 kg (400 lb.) load] Fig. 281 [over 181kg (400 lb.) load]

2.4 HANGERS AND SUPPORTS

.1 All piping shall be supported by adjustable clevis hangers sized to suit the O.D. of the pipe. (*** also see 3.3.9 & adjust)

.2 All pipe hangers and trapeze hangers shall be supported by mild steel rod of the correct diameter to suit the hanger, as recommended by the steel manufacturer.

.3 The load of any hanger rod shall not exceed the capacity indicated in the following table:

Rod Diameter	Maximum Safe Load, Pounds
6 mm (1/4")	136 kg (300lbs)
9 mm (3/8")	277 kg (610 lbs)
13 mm (1/2")	512 kg (1130 lbs)
16 mm (5/8")	821 kg (1810 lbs)
19 mm (3/4")	1229 kg (2710 lbs)

.4 All vertical runs of pipe shall be supported at each floor by Grinnell Fig. 261 riser clamps. Clamps on copper pipe shall be copper plated.

.5 Support piping adjacent to large motor driven equipment equipped with spring isolation Fig. 178 cushion hangers. Also, piping adjacent to major pieces of equipment such as boilers, chillers, heat exchanger, etc. shall be supported on Fig. 178 cushion hangers.

2.5 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.6 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.8 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00- Cast-in-Place Concrete.

2.9 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Miscellaneous Metals. Submit calculations with shop drawings.

2.10 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Provide sufficient hangers, supports, anchors, guides, vibration dampeners, flexible connectors, restraints and sway braces that will cope with the loads, moments and stresses developed in the piping system and prevent these loads and moments from being transferred to the equipment to which the piping is connected.

.2 Sway braces and vibration dampeners to be Grinnell Fig. 297, Fig. 298, Fig. 302, or Fig. 303 with Fig. 305 anchors. Pipe alignment guides to be Grinnell Fig. 256.

.3 Connect all piping systems to equipment without springing the pipes or transferring any loads or moments to the equipment.

.4 The use of tees in bullhead configuration is unacceptable.

3.3 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.3 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.5 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.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.

3.4 HANGER SPACING

.1 Plumbing piping: to Provincial Code.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.6 Piping suspended with hangers shall have the following hanger size and spacing:

All piping (except copper and PVC)

Pipe Size	Rod Diameter	Max. Spacing
30 mm (1-1/4") & under	10 mm (3/8")	2450 mm (8')
35 mm (1-1/2") to 50 mm (2")	10 mm (3/8")	3000 mm (10')
65 mm (2-1/2") to 85 mm (3-1/2")	12 mm (1/2")	3650 mm (12')
100 mm (4")	16 mm (5/8")	3650 mm (12')
150 mm (6")	19 mm (3/4")	3650 mm (12')

Copper Pipe

Pipe Size	Rod Diameter	Max. Spacing
25 mm (1") & under	10 mm (3/8")	1825 mm (6')
30 mm (1-1/4") to 35 mm (1-1/2")	10 mm (3/8")	2450 mm (8')
50 mm (2") and 65 mm (2-1/2")	12 mm (1/2")	2750 mm (9')

PVC (Schedule 40) & CPVC Pipe Size	Rod Diameter	Max. Spacing(PVC)	Max. Spacing(CPVC)
35 mm (1 1/2") & under	10 mm (3/8")	1500 mm (5')	

PVC (Schedule 40) & CPVC Pipe Size	Rod Diameter	Max. Spacing(PVC)	Max. Spacing(CPVC)
50 mm (2") to 75 mm(3")	12 mm (1/2")	1800 mm (6')	1100 mm (4')
100 mm (4")	12 mm (1/2")	2500 mm (8')	1400 mm (4'6)
150 mm (6")	19 mm (3/4")	2800 mm (9')	1500 mm (5')
200 mm (8")	19 mm (3/4")	3000 mm (10')	

.7 Install hangers within 300 mm (12") of each horizontal elbow.

.8 Cast iron piping with mechanical joints shall have a hanger on both sides of all joints.

.9 Where floor or roof structural system consists of joists, piping shall be supported by means of angles spanning the top chords of adjacent joists. The number of joists to be spanned shall be determined by the incident load of piping.

.10 In no case shall the hanging of piping directly from roof decking be allowed, unless special permission is obtained from the Contact Administrator.

.11 Groups of horizontal pipes may be supported by trapeze hangers constructed of angle iron with steel rods. They shall conform to the above concerning isolation of copper piping, pipe covering protection saddles and roller supports. Pipe covering protection saddles will be required on all insulated pipe at trapeze supports.

.12 Where desired, several individual hanger rods may be supported from a trapeze.

.13 All hanger rods shall have sufficient threaded length to allow for vertical adjustment of hangers after pipe is in place. Use two (2) nuts on each rod, one above the clevis or angle iron and one below.

.14 Hangers for insulated cold piping shall be oversized to match outside diameter of insulation and provided with a protection saddle of 16 ga. galvanized sheet steel, rolled to match the outside diameter of the insulation. The saddle shall cover approximately the bottom one third of the circumference of the insulation. The length shall be at least as long as that recommended by the insulation manufacturer.

.15 Where pipe or equipment is supported from floors or walls, structural steel supports shall be fabricated using welded joints except where provision is required for adjustment. Where details of construction are not indicated, drawings shall be submitted to the Contract Administrator for approval before fabrication.

.16 Vertical piping other than risers through floors shall be provided with suitable supports, sway braces, etc. Clamps should be located immediately below a coupling where possible. Risers up to 50 mm (2") size shall be braced at intervals not over 2100 mm (7'0").

3.5 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.6 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.7 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.8 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of duct work, actuators, and controllers, including the installation and location of identification systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

1.3 SUBMITTALS

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

.2 Submit product data for paint colour samples and other products specified in this section.

.3 Submit samples of nameplates, labels, and tags prior to fabrication of these items.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

.3 Equipment in Chlorination Rooms: use size # 9.

.4 Equipment in Tonner Storage Rooms: use size # 9

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Contract Administrator.

2.4 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.5 CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

2.6 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.7 LANGUAGE

.1 Identification in English.

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 - Painting has been completed.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.4 LOCATION OF IDENTIFICATION ON DUCTWORK SYSTEMS

.1 On both sides of visual obstruction or where run is difficult to follow.

.2 At point immediately upstream of major manually operated or automatically controlled dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.3 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 CONTROLLERS

.1 Controllers: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams and equipment schedule mounted in frame behind non-glare glass where directed by Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 NBCC National Building Code of Canada - 2020

.2 AABC Associated Air Balance Council, MN-1-2002

.3 NEBB National Environmental Balancing Bureau, TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998

.4 SMACNA Sheet Metal and Air Conditioning Contractors' National Association, HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002

.5 NFPA National Fire Protection Association, Code 90

.6 ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers

1.2 SUMMARY

.1 Testing, Adjusting, and Balancing (TAB) is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

.3 TAB Standard means the testing and balancing standard under which the TAB personnel's qualifications are approved and include one of the following:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002; or

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems – Testing, Adjusting and Balancing-2002.

1.3 SUBMITTALS

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

.2 Submit, prior to commencement of TAB, the qualifications of the TAB personnel as detailed in Item 1.4.

.3 Submit, in advance of the start of construction, confirmation in writing of the adequacy of provisions for TAB and other aspects of design and installation pertinent to the success of TAB as detailed in Item 1.9.

.4 Submit, prior to commencement of TAB, the proposed method for completing TAB.

.5 Submit the preliminary TAB Report as detailed in Item 1.16.

.6 Submit the TAB Report as detailed in Item 1.17.

1.4 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Contract Administrator within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.5 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.

.4 Independent TAB to be completed at each station.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 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.

1.8 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started and confirm in writing to Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contract Administrator 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.

1.9 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

1.10 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.11 START OF TAB

.1 Notify Contract Administrator 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 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, are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Access doors, installed, closed.

.7 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 Coils correctly piped, fins straight and clean.

.7 Automatic temperature control system in operation.

1.12 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Tonner Storage Room HVAC systems: plus 10 %, minus 0 %.

.2 Chlorination Equipment room HVAC systems: plus 5 %, minus 5 %.

1.13 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.14 INSTRUMENTS

.1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.2 Calibrate within 3 months of TAB. Provide certificate of calibration to Contract Administrator.

1.15 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.16 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Contract Administrator, 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.

1.17 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 3 copies of TAB Report to Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.

1.18 VERIFICATION

.1 Reported results subject to verification by Contract Administrator.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Contract Administrator.

.4 Pay costs to repeat TAB as required to satisfaction of Contract Administrator.

1.19 SETTINGS

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.20 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.21 AIR SYSTEMS

.1 Standard: TAB to most stringent of TAB standards of NEBB, SMACNA, ASHRAE.

.2 Prepare and submit to the Contract Administrator an air balance report with data showing compliance with the design and that quantities at each outlet grille, diffuser, return air grille, exhaust grille and fan unit are within 4% (four percent) of design figure. The report shall include specified and measured data on fan performance including horsepower, load amperage, speed, and static pressure (total).

.3 Do TAB of following systems, equipment, components, controls:

.1 Tonner storage room air handling unit and connected ductworks.

.2 Tonner storage room occupied exhaust fan and connected ductworks.

.3 Tonner storage room un-occupied exhaust fan and connected ductworks.

.4 Chlorination equipment room supply fan and connected ductworks.

.5 Chlorination equipment room exhaust fan and connected ductworks.

.6 Instantaneous tepid water heater and connected piping.

.4 Qualifications: personnel performing TAB qualified to standards of AABC.

.5 Balancing of fan unit and low pressure duct air flow shall be by the means of a pitot traverse on all main and branch supply ducts. Each outlet shall be adjusted by anemometer, anemotherm, or velometer readings to provide air quantities. Each outlet shall be adjusted to provide proper thrown and distribution in accordance with the Contract Administrator's requirements.

.6 Upon completion of air balances and submittal of the air balance report, this trade shall provide, if called upon, a spot check of the system with the Contract Administrator. If actual air quantities do not agree with the air balancing report data, this trade may be called upon to completely rebalance the system until satisfactory to the Engineer.

.7 All necessary, temporary equipment, gauges, Anemotherms, pitot tubes, tachometers, anometers, etc., required for testing and air balance shall be furnished by this trade and be of quality and capacity to ensure that the accuracy specified or generally accepted. The Contract Administrator may require calibration of instruments if desired.

.8 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet

bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.9 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.10 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

.11 Tonner storage room un-occupied exhaust fan should be balanced (three set points) to ensure that the negative pressure within the tonner storage room does not exceed allowable maximum.

.1 Allowable maximum negative pressure is the pressure differential that results in the maximum exit door opening force as outlined within the National Building Code (NBCC).

1.22 OPERATIONAL TESTING FIRE/SMOKE DAMPERS

.1 Provide for the operational testing of each fire or smoke damper in conformance with NFPA Code 90.

.2 Operate each damper by removing the fusible link and manually stroking the damper to check for binding.

.3 Install a remote release pin and release the damper from an open position to verify operation and full closure.

.4 Any dampers that fail to close completely, balk or bind are to be reported to the installing contractor for repair and then retested.

.5 Prepare a signed report detailing each damper by location or number, size, type and verifying that the tests were positive. Report should list the name of the technician performing the tests.

1.23 POST-OCCUPANCY TAB

.1 Emergency evacuation: participate in full scale emergency evacuation exercises. Repeat smoke management tests at this time.

.2 Participate in systems checks twice - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

PART 2 PRODUCTS

.1 Not used.

PART 3 EXECUTION

.1 Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Definitions:

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means “not concealed" as previously defined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

.2 Reference Standards:

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-13, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.3 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practices Guide (2013).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

.2 Submit the qualifications of the installer upon request by Contract Administrator.

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 and ULC markings.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Exhaust and conditioned air supply ductwork insulation shall be Fiberglas type FRK, 25 mm (1") thickness duct insulation. Use flexible duct insulation for sizes 300 x 300 (12" x 12") and smaller, and all round ducts. Ducts with any dimensions 350 mm (14") or larger shall be insulated with rigid insulation.

.2 Outdoor air inlet, relief air ductwork, and return air ductwork shall be insulated with 50 mm (2") thick Neoprene coated fibreglass duct liner unless otherwise shown on drawings.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

2.4 ACCESSORIES

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick-setting

.3 Canvas adhesive: washable.

.4 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

.2 Ensure surfaces are clean, dry, free from foreign material.

.3 Apply so the finished application has the full specified thickness or insulation. Flexible duct insulation applied too tightly will be removed and reapplied properly.

.4 Impale rigid and board style insulation on No. 9 insulation pins at 300 mm (12”) on centre and secured with 50 mm (2”) diameter speed washers.

.5 All exposed fibreglass ductwork insulation to be finished with 6 ounce canvas and two coats of adhesive to form a fire retardant jacket.

3.2 SEALING

.1 Seal all exterior foil type vapour jacket duct insulation with 100 mm (4") wide RFFRK self adhesive tape applied over all retaining pins, longitudinal and butt joints, and along other breaks in the vapour barrier to provide a continuous vapour seal.

3.3 CLEANING

.1 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 procedures for control of air flow rates.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

1.3 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.

Part 2 Products

2.1 DAMPERS

.1 Operating type dampers are specified in Section 23 33 15.01 and Section 23 33 15.02.

2.2 DAMPER OPERATORS

.1 Product requirements for damper operators are specified in Section 40 92 00.

2.3 ELECTRIC DUCT HEATERS CONTROL

.1 Product requirements for electric duct heater controls are specified in Section 40 92 00.

2.4 AIR HANDLING UNIT CONTROLS

.1 Product requirements for air handler controls are specified in Section 40 92 00.

2.5 ELECTRIC FORCED FLOW HEATER CONTROLS

.1 Product requirements for heating equipment controls are specified in Section 40 92 00.

2.6 EXHAUST FAN CONTROLS

.1 Product requirements for exhaust fan controls are specified in Section 40 92 00.

2.7 SUPPLY FAN CONTROLS

.1 Product requirements for supply fan controls are specified in Section 40 92 00.

2.8 TOXIC CHEMICAL SCRUBBER CONTROLS

.1 Product requirements for scrubber equipment controls are specified in Section 40 92 00.

Part 3 Execution

3.1 TONNER ROOM AIR SUPPLY

.1 The unit shall maintain:

.1 A 22°C (adjustable) Tonner room heating setpoint.

.2 Run Conditions:

.1 The unit shall run according to the following modes:

.1 HAND: With the H-O-A switch in HAND position the supply fans shall start and run continuously, subject to safeties and alarms.

.2 OFF: With the H-O-A switch in OFF position the supply fans shall stop.

.3 AUTO: With the H-O-A switch in the AUTO position the PLC shall energize the supply fans, subject to safeties and alarms.

.2 Tonner Room Occupied Operation Start-up

.1 On a Tonner Room occupied signal received to the PLC, the PLC prove there is no chlorine alarm signal present.

.2 The PLC will operate the Air Handling Unit and occupied exhaust fan EF-C640 to Run.

.1 Maclean this is AHU-C601

.2 Hurst this is AHU-C602 (AHU-C601 is for Emergency Operations and is turned off)

.3 McPhillips this is AHU-C602 (AHU-C601 is for Emergency Operations and is turned off))

.3 Tonner Room Emergency Operation Start-up

.1 On a Tonner Room chlorine alarm (from tonner room or scale room) received to the PLC, the PLC will command the occupied exhaust fan EF-C640 and unoccupied exhaust EF-C641 to turn off.

.2 The HVAC supply damper and the scrubber SCBR-C670 exhaust damper will open. Once dampers are proved open, scrubber SCBR-C670 will run.

.3 The PLC will operate the air handling unit to operate and modulate the speed of the fan to maintain differential pressure setpoint (user defined) in the Tonner Room. PLC will monitor different pressure between the inside and outside of the Tonner Room by transmitter PDT-C6012.

.1 For Maclean, emergency operation will run air handling unit AHU-C601.

.2 For Hurst and McPhillips, a second air handling Unit, AHU-C601, will run in emergency operation with AHU-C602 being turned off.

.4 At McPhillips Pumping Station, on a signal from the PLC the system will power the modulating flow damper (FV-C6011) to the setpoint (user

defined). Setpoint will be determined during commissioning for proper balancing.

.1 Modulating flow damper FV-C6011 will be fully closed during occupied and unoccupied states.

.2 MacLean and Hurst do not have a modulating flow damper.

.5 At MacLean Pumping Station, on a signal from the PLC the system will power emergency on/off flow damper (XV-C6011) open to allow for more supply air for proper balancing.

.1 ON/OFF damper XV-C6011 will be closed during occupied and unoccupied states.

.2 McPhillips and Hurst do not have an emergency on/off damper

.4 Shutdown (Unoccupied operation)

.1 On an occupied state signal being removed to the PLC, the PLC will command exhaust damper and fan EF-C641 to open and run.

.2 The PLC will command the air handling unit AHU-C601 and exhaust EF-C640 to turn off.

.1 For McPhillips and Hurst, the PLC will prove the return air damper for AHU-C602 is closed in addition to Section 3.1.2.4.1.

.3 The supply fan for AHU-C601, and the exhaust fan EF-C640 deenergize.

.1 For McPhillips, the supply fan for AHU-C601, AHU-C602, and the exhaust fan EF-C640 deenergize.

.5 Supply air temperature Setpoint Adjust:

.1 The occupant shall be able to adjust the supply air temperature heating setpoint. This will be done at the Air Handling Unit HMI screen located in the Tonner Room.

.6 Supply Fan (AHU-C601, AHU-C602):

.1 The supply fans shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adjustable) minimum runtime. However, both AHU-C601 and AHU-C602 should not operate simultaneously due to potential loading issues.

.7 Electric Heating (AHU-C601, AHU-C602):

.1 The controller shall measure the supply air temperature and modulate the heating coil to maintain its heating setpoint. This is done in internally within the AHU.

.8 Final Filter Differential Pressure Monitor:

.1 The controller shall monitor the differential pressure across the final filter (AHU-C601, AHU-C602). There will be an alarm shown on the associated AHU HMI located in the Tonner Room.

.9 Supply Air Temperature TT-C6042:

.1 The PLC controller shall monitor the supply air temperature.

.2 Alarms shall be provided as follows:

.1 High Supply Air Temp: If the supply air temperature is greater than 49°C (user-adjustable).

.2 Low Supply Air Temp: If the supply air temperature is less than 7°C (user-adjustable).

3.2 CHLORINE EQUIPMENT ROOM AIR SUPPLY

.1 The unit shall maintain:

.1 A 22°C (adjustable) Chlorine Equipment room heating setpoint.

.2 Run Conditions:

.1 The units (SF-C630 and EF-C642) shall run according to the following modes:

.1 HAND: With the ON/OFF switch in the ON position the supply fans shall start and run continuously, subject to safeties and alarms.

.2 OFF: With the ONN/OFF switch in OFF position the supply fans shall stop.

.3 There is no PLC control for the fans in the equipment room.

.2 Chlorine Equipment Operation Start-up

.1 When the associated ON/OFF switch is in the ON position, the supply fan SF-C630 dampers will open. When damper is proven the supply fan SF-C630 will energize and run.

.2 When the associated ON/OFF switch is in the ON position, the exhaust fan EF-C642 dampers will open. When damper is proven the exhaust fan EF-C642 will energize and run.

.3 When dampers are proven the supply fan SF-C630, and the exhaust fan EF-C642 will energize and run.

.3 Shutdown

.1 When the associated ON/OFF switch is in the OFF position the return air damper for SF-C630 will move to a closed position. The supply fan SF-C630 deenergize

.2 When the associated ON/OFF switch is in the OFF position the return air damper for EF-C642 will move to a closed position. The exhaust fan SF-C642 deenergize

.4 Electric Heating (HCE-C620):

.1 The controller shall measure the supply air temperature and modulate the heating coil to maintain desired temperature setpoint.

.2 The heating shall be enabled whenever:

.1 Outside air temperature (TT-C6043) is less than 10°C (user-adjustable).

.1 Note that for McPhillips, there is an existing outdoor air transmitter TT-M6041 located outside at the main pumphouse that monitors outdoor temperature into the existing HVAC PLC. Use this signal for the logic.

.2 AND the supply fan status is on.

.3 Temperature to be controlled by the field mounted thermostat associated with the electric heater.

.5 Supply Air Temperature TT-C6041:

.1 The PLC controller shall monitor the supply air temperature.

.2 Alarms shall be provided as follows:

.1 High Supply Air Temp: If the supply air temperature is greater than 49°C (adjustable).

.2 Low Supply Air Temp: If the supply air temperature is less than 7°C (adjustable).

.6 Refer to the Process Control Narratives in Appendix C of the tender for additional electronic controls/alarms/statues to be implemented by the Contractor.

.1 Control Narrative – Chlorine Upgrades – MacLean Pumping Station.

.2 Control Narrative – Chlorine Upgrades – McPhillips Pumping Station.

.3 Control Narrative – Chlorine Upgrades – Hurst Pumping Station.

3.3 IDENTIFICATION

.1 Provide in accordance with Section 23 05 54 - Mechanical Identification.

3.4 MANUFACTURER'S INSTRUCTIONS

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

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Contract Administrators (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A480/A480M-2018, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-2015, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A653/A653M-2018, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Green Seal Environmental Standards (GS)

.1 GS-36-2013, Standard for Adhesives for Commercial Use.

.4 National Fire Protection Association (NFPA)

.1 NFPA 90A-2018, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-2018, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-2017, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2017.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 2007.

1.2 RELATED WORK

.1 Section 23 33 00 – Air Duct Accessories

.2 Section 23 07 13– Duct Insulation

.3 Section 07 84 00 – Fire Stopping

1.3 QUALIFICATIONS

.1 Ductwork shall be installed by qualified workmen who are fully familiar with the SMACNA and ASHRAE Duct Construction Standards.

.2 Systems and equipment shall be installed by qualified workmen who are familiar with

this work and have a working knowledge of the system components.

.3 Contractor shall be fully aware of the Provincial regulations governing the details of this work regarding the installation of fire dampers, electric heating equipment, etc.

1.4 LOCAL REGULATIONS

.1 Work shall be installed in accordance with local regulations governing this work except where more stringent requirements are specified under this section.

.2 Where local regulations are at variance with contract specifications, work shall be installed in accordance with local regulations at no additional cost to this contract, after obtaining Contract Administrator's approval.

1.5 DIMENSIONS

.1 Duct dimensions shown on the drawings are inside sizes. Ducts lined with insulation, shall be increased in size as required to maintain specified internal dimensions.

1.6 BRACING

.1 Ductwork shall be braced to prevent movement. Additional bracing and/or supports shall be provided at no extra cost to the City where required by the inspection authority.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Test and Evaluation Reports:

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.8 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

PART 2 PRODUCTS

2.1 DUCTWORK

.1 Sheet metal ductwork shall be constructed in accordance with the latest editions of applicable NFPA Standards; SMACNA HVAC Duct Construction Standards, Metal and Flexible, 500 Pa (2 in wg) class; ASHRAE Equipment Guide and Detail Drawings included with this specification.

.2 Duct hangers shall be constructed in accordance with SMACNA Low Pressure Duct Construction Standards or as further specified.

.3 Internal reinforcing is not acceptable.

2.2 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

.2 Seal classification:

.1 Class C: transverse joints and connections made air tight with gaskets, tape or combination thereof. Longitudinal seams unsealed.

.2 Unsealed seams and joints.

2.3 DUCT SEALANT

.1 All low pressure ductwork shall be Duro Dyne DWN water-based duct sealer or approved equal in accordance with B7 applied to joints and seams.

2.4 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.5 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.6 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: centreline radius: 1.5 times width of duct.

.2 Round: five piece , centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 407 mm: with double thickness turning vanes.

.2 Over 407 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.7 INSULATION

.1 Insulation to follow Section 23 07 13 – Duct Insulation.

2.8 FIRE STOPPING

.1 Fire stopping to follow Section 07 84 00 – Fire Stopping.

2.9 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.10 ALUMINUM

.1 To SMACNA . Aluminum type: 3003-H-14 .

.2 Thickness, fabrication and reinforcement: to SMACNA .

.3 Joints: to SMACNA .

2.11 HANGERS AND SUPPORTS

.1 Hangers and Supports:

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with black steel rods to SMACNA:

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.

3.2 GENERAL

.1 Do work: SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers: SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.3 DUCTWORK

.1 Sheet metal ductwork shall be installed in accordance with the recommendations of the SMACNA Low Velocity Ductwork Standards. Double thickness turning vanes shall be installed in all 90^{o} square turn elbows having no change in dimension through turn.

.2 Where duct elbows are round, they shall have a radius dimension of 1 1/2 times the width of duct (in the plane of the turn) to the center line of the duct.

.3 No turning vanes shall be installed in duct elbows that are branch duct connections to plenums or directly behind return air grilles.

.4 Variation of duct sizes will be permitted only after obtaining written permission of the Contract Administrator.

.5 Rectangular ductwork exceeding 450 mm (18") in any dimension shall be stiffened by breaking the sheets diagonally. Cross breaking may be omitted for insulated ductwork, provided ducts are 2 gauges heavier than scheduled.

.6 Rectangular ducts shall be constructed by breaking the corners and grooving the longitudinal seams using Pittsburg seam or other approved airtight seam.

.7 All laps in sheet metal shall be in the direction of air flow. All edges and slips shall be hammered down to leave a smooth interior duct.

3.4 DUCT JOINT SEALING

.1 Clean all ductwork prior to application of sealer to ensure that it is dry and free of grease, etc. Seal shall consist of a 6 mm (1/4") bead of the material along all joints, which when dry shall be minimum 3 mm (1/8") thick at joints and seams and shall extend a minimum of 13 mm (1/2") on each side of the joint.

.2 Application shall be in strict accordance with the sealant manufacturer's recommendations. Samples shall be submitted to the Contract Administrator on request.

3.5 SUPPORTS

.1 Type S1 or A1 as detailed on drawings or approved equal as per B7.

3.6 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: SMACNA.

.4 Supports shall secure ducts and equipment, prevent sway, sag and duct vibrations, provide for expansion and contraction, and shall have a neat appearance.

.5 Supports shall be designed for strength and rigidity in a manner which does not stress the building construction.

.6 Take care not to weaken concrete or penetrate waterproofing.

.7 In buildings constructed of precast sections, hangers shall be suspended as recommended

by the precast supplier.

.8 Vertical ducts shall be supported at each floor unless otherwise required by expansion conditions or otherwise directed. Ducts shall be supported by means of angle iron collars bearing on each floor slab.

.9 If possible, hangers and supports for covered ducts shall not injure or pierce insulation. If there is no alternative, the insulation covering shall be repaired to Contract Administrator's satisfaction.

.10 Provide sheet metal shields to protect insulation at areas of contact with hangers and supports.

.11 Where floor or roof structural system consists of joists, piping shall be supported by means of angles spanning the top chords of adjacent joists. The number of joists to be spanned shall be determined by the incident load of piping.

.12 Attach ducts located on roofs on sleepers, curbs or pads mechanically and rigidly attached to the structure, to adequately resist wind forces.

3.7 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.8 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

1.1 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

.2 American Society for Testing and Material (ASTM)

.1 ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.3 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2 with galvanized metal for connections.

2.3 EXPANSION JOINTS

.1 Material:

.1 Fire resistant, self extinguishing (ASTM D635), EPDM synthetic rubber tube and cover, reinforced with a suitable woven fabric and steel rings support, and temperature rated at minus 40 degrees C to plus 50 degrees C.

.2 Connection flanges drilled to 150# class standards, and be full rubber faced and integral to the body. Split flange backing rings of galvanized carbon steel shall be provided.

.3 Flexible connections shall be capable of accommodating piping/ducting system and equipment movements and vibration as needed.

2.4 ACCESS DOORS IN DUCTS

.1 Access doors are required to be located at every firs damper location.

.2 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.3 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.4 Gaskets: neoprene.

.5 Hardware:

.1 Up to 300 x 300 mm: two sash locks.

.6 Where hinged access doors are inconvenient, removable doors with 4 cam locks are acceptable.

2.5 DYNAMIC FIRE DAMPERS

.1 Static fire dampers to be in accordance with Section 07 84 00 - Fire Stopping on both sides of fire separation for both fire closure temperature and fire resistance rating.

.2 Dampers shall have a minimum differential pressure rating of 4 in. wg. Unless otherwise specified.

.3 Dampers shall have a minimum velocity rating of 2000 fpm. Unless otherwise specified.

.4 Frame will be stainless steel in gauges required by manufacturer’s UL listing.

.5 Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer’s UL listing.

.6 Damper shall be supplied with fusible link.

.7 Finish shall be stainless steel.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

.1 Examine areas to receive dampers. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization of dampers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.3 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:
  .1 Inlets and outlets to supply air units and fans.
.2 Length of connection: 100 mm.
.3 Minimum distance between metal parts when system in operation: 75 mm.
.4 Install in accordance with recommendations of SMACNA.
.5 When fan is running:
  .1 Ducting on sides of flexible connection to be in alignment.
  .2 Ensure slack material in flexible connection.

.2 Expansion Joints

.1 Install in following locations:
  .1 Inlets to toxic chemical scrubbing units.
.2 Minimum compression capability: 50mm
.3 Minimum extension capability: 75mm
.4 Install in accordance with recommendations of SMACNA.
.5 Ensure expansion joints are installed at neutral position.

.3 Access Doors and Viewing Panels:

.1 Size:
  .1 200 x 200 mm for viewing; where space is available.
.2 Locations:
  .1 Control dampers.
  .2 Static Fire Dampers
  .3 Devices requiring maintenance.
  .4 Required by code.
  .5 Heating coils.
  .6 Elsewhere as indicated.

.4 Dynamic Fire Dampers:

.1 Install in accordance with recommendations of SMACNA.
.2 Install in accordance with recommendations of manufacturers instructions.
.3 Install dampers in accordance with Section 07 84 00 – Fire Stopping. Any damper installation that is not in accordance with the manufacturer's UL Installation Instructions must be approved prior to installation.
.4 Dampers must be accessible to allow inspection, adjustment, and replacement of components. The sheet metal contractor shall furnish any access doors in ductwork or plenums required to provide this access. The general contractor shall furnish any access doors required in walls, ceilings, or other general building construction.
.5 The installing contractor shall provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.
.6 Do not compress or stretch the damper frame into the duct or opening.
.7 Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required.

.8 Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft.

.5 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Contract Administrator.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

3.4 CLEANING

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.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 Balancing dampers for dry well supply and exhaust air system.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.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 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.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 BALANCE DAMPERS

.1 Material: 304 stainless steel, factory manufactured.

.2 Opposed blade: 1.6 mm thick 304 stainless steel, symmetrical about pivot point.

.3 Maximum blade height: 100 mm.

.4 Bearings: stainless steel sleeve pressed into cast housing bolted to the damper frame.

.5 Linkage: located in jamb out of airstream and constructed of minimum 3.5 mm stainless steel double clevis arms with 4.8 x 19 stainless steel tie bars pivoting on 9.5 mm diameter stainless steel pivot pins with lock type retainers.

.6 Blade Seals: TPE, mechanically attached to blade.

.7 Channel frame: 16 ga. hat channel, 304 stainless steel.

.8 Acceptable Materials: Ruskin, Greenheck or approved equal in accordance with B7.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Dampers: vibration free.

.4 Ensure damper operators are observable and accessible.

.5 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.6 Corrections and adjustments as directed by Contract Administrator.

3.3 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Operating dampers for mechanical forced air ventilation systems.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

.1 Performance data.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.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 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.

Part 2 Products

2.1 OUTDOOR AIR AND EXHAUST DAMPERS AND DAMPER OPERATORS

.1 Multi-blade type, opposed or parallel as indicated on schedule.

.2 Frame:

.1 Extruded aluminum (6063-T5) not be less than 0.080” (2.03 mm) in thickness.

.2 101.6 mm deep x 25.4 mm, with duct mounting flanges on both sides of frame.

.3 50.8 mm mounting flange on the rear of the damper.

.4 Assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.3 Blades:

.1 Maximum 162.6 mm deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 1.52mm.

.2 Internally insulated with expanded polyurethane foam; thermally broken.

.3 Insulating factor of R-2.29 and a temperature index of 55 (tested to AAMA 1502.7 Test Method).

.4 Blade seals:

.1 Extruded silicone, secured in an integral slot within the aluminum blade extrusions.

.2 Mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals are not acceptable.

.5 Frame seals:

.1 Extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.6 Bearings:

.1 Dual bearing system composed of a Celcon inner bearing (fixed around a 11.1 mm aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame.

.2 Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

.7 Hexagonal control shaft:

.1 Size: 11.1 mm.

.2 Adjustable length; integral part of the blade axle. A field-applied control shaft shall not be acceptable.

.3 All parts zinc-plated steel.

.8 Linkage hardware:

.1 Aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation.

.2 Complete with cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing metal will not be approved.

.9 Performance:

.1 Designed for operation in temperatures ranging from -40°C to 100°C.

.2 AMCA rated for Leakage Class 1A at 0.25 kPa static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.10 Dampers shall be custom made to required size, with blade stops not exceeding 31.7 mm in height.

.11 Acceptable materials: Tamco 9000SC or approved equal in accordance with B7.

.12 Operators:

.1 Refer to Section 40 92 00.

2.2 CHLORINE SCRUBBER EXHAUST DAMPERS AND DAMPER OPERATORS

.1 Multi-blade type, opposed or parallel as indicated on schedule.

.2 Frame:

.1 Fiberglass-reinforced polymer (FRP) not be less than 1/8" wall thickness.

.2 101.6 mm deep x 25.4 mm, with duct mounting flanges on both sides of frame.

.3 50.8 mm mounting flange on the rear of the damper.

.4 Assembled using 316 stainless steel mounting fasteners. Welded frames shall not be acceptable.

.3 Blades:

.1 Maximum 6-1/4" wide extruded FRP air-foil profiles with a minimum wall thickness of 1/8".

.2 Insulating factor of R-2.29 and a temperature index of 55 (tested to AAMA 1502.7 Test Method).

.4 Blade seals:

.1 Nitrile, secured in an integral slot within the FRP blade extrusions.

.2 Mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals are not acceptable.

.5 Frame seals:

.1 Nitrile, secured in an integral slot within the FRP frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper.

.6 Bearings:

.1 Bearing system composed of a Teflon molded thermoplastic, designed based on system pressure.

.7 Control shaft:

.1 Adjustable length; integral part of the blade axle. A field-applied control shaft shall not be acceptable.

.2 Damper axles shall be minimum ⅝" dia. pultruded construction vinyl ester resin rods.

.8 Linkage hardware:

.1 Damper blade linkage shall consist of an FRP tie bar, air stream mounted on the inlet side of the blade with 316 stainless steel hardware. Must be accessible after installation.

.9 Performance:

.1 Designed for operation in temperatures ranging from -40°C to 100°C.

.2 AMCA rated for Leakage Class 1A at 0.25 kPa static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.10 Dampers shall be custom made to required size, with blade stops not exceeding 31.7 mm in height.

.11 Acceptable materials: Fiberglass-reinforced polymer (FRP) Hartzell FCO or FCP Dampers or approved equal in accordance with B7.

.12 Operators:

.1 Refer to Section 40 92 00.

2.3 SUPPLY BACK DRAFT DAMPERS

.1 Frame:

.1 Extruded aluminum (6063-T5) not be less than 0.060" (1.52 mm) in thickness.

.2 63.5 mm deep.

.3 Assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.2 Blades:

.1 Maximum 127 mm deep extruded aluminum (6063-T5) profiles with a minimum wall thickness of 1.52 mm.

.3 Blade seals:

.1 Extruded silicone, secured in an integral slot within the aluminum blade extrusions; mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals are not acceptable.

.4 Frame seals:

.1 Extruded silicone, secured in an integral slot within the aluminum frame extrusions; mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.5 Bearings:

.1 Maintenance-free bearings system composed of a 12.7 mm aluminum pivot point rotating in a Celcon bearing.

.6 Linkage hardware:

.1 Hard alloy aluminum (6005-T6) crank arms fastened to aluminum pivot rods and secured within a channel running along top of blades.

.2 Large diameter, 8.73 mm, hard alloy aluminum (6065-T6C) linkage rod connect the crank arms by means of a zinc-plated steel trunnion.

.3 Complete with cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing metal will not be approved.

.7 Performance:

.1 Designed for operation in temperatures ranging from -40°C to 100°C.

.2 AMCA rated for Leakage Class 1A at 0.25 kPa static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.8 Provide weights to maintain backpressure of 25 Pa (adj.) as per Section 40 92 00 of the specifications.

.9 Dampers to be custom made to required size.

.10 Acceptable materials: Tamco 7000WT or approved equal in accordance with B7

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL CONDITIONS

.1 Section Includes:

.1 Materials and specifications of exhaust fans

1.2 REFERENCES

.1 All equipment and piping shall be designed and manufactured in accordance with the following applicable current recommendations and standards:

.1 ASME American Society of Mechanical Engineers
.2 ASTM American Society for Testing and Materials
.3 ANSI American National Standards Institute
.4 AMCA Air Movement & Control Association
.5 IEEE Institute of Electrical and Electronics Engineers
.6 CEC Canadian Electric Code
.7 CSA Canadian Standards Association
.8 AHRI Air-Conditioning, Heating, and Refrigeration Institute
.9 NFPA National Fire protection Association
.10 ISA International Society of Automation
.11 ISO International Organization for Standardization
.12 NEMA National Electrical Manufacturers association
.13 ULC Underwriters Laboratories Canada

.2 In addition to the latest revision of the codes and standards contained in the above, work shall conform to any applicable Federal, Provincial and Municipal codes and regulations. In the event of conflict between the referenced codes and standards, drawings, specifications, data sheets, and/or the Purchase Order, Vendor shall obtain clarification before proceeding with the work

1.3 WORK INCLUDED

.1 Detail engineering of the exhaust fans.

.1 Supply all components for a complete and functional unit.
.2 Shipping of material and equipment.
.3 Provide all assembly/manufacturers' instructions and manuals required for installation and to make the units operational.
.4 Factory run testing of the unit prior to shipping, with test report. Factory testing shall also include vibration amplitude measurement and balancing and testing at the factory.
.5 Provide list of suggested critical and commissioning spares parts with associated costs.
.6 Provide specifications sheets and drawings of the units for approval prior to fabrication.

.7 Include with your proposal the milestones (after contract awarded) for:

.1 Shop drawings for approval

.2 Certified drawings

.3 Shop inspection and testing date

.4 Package shipping date

.2 The Work described herein shall be performed in accordance with the Specifications, Design Standards, Datasheets and Drawings provided as part of the Contract Documents and shall govern and amplify, as applicable, the requirements of workmanship, design, construction, and general execution of the Work.

1.4 RELATED SECTIONS

.1 The following list includes specific items of work related to the air distribution systems which are to be provided under other sections:

.1	Testing, Adjusting, and Balancing for HVAC	Section 23 05 93
.2	Electric and Electric Control Systems for HVAC	Section 23 09 33
.3	Site Conditions	Section 02 22 10.01

1.5 SUBMITTALS

.1 General Requirements

.1 Electronic copies of general arrangement drawings as AutoCAD files shall be included

.2 All equipment shall be identified by the Contract Administrator-assigned equipment numbers.

.2 Technical Information to be included with bid

.1 In addition to the requirements of the commercial documentation, the Vendor shall include with their Bid the following documents:

.1 Complete scope of supply identifying all components included.

.2 Drawings and documents fully describing/illustrating:

.1 General arrangement and section drawings with physical dimensions and weights of the equipment and ancillaries specified

.2 Fan performance curve

.3 All necessary clearances around the equipment for operation and maintenance

.4 Complete list of package components with overall dimensions and weights

.5 Preliminary load data (static and dynamic) for foundation / support design

.6 Electrical loads

.7 Instrument list

.8 Description of control system

.9 Installation list for comparable equipment.

1.6 UNIT OF MEASUREMENT

.1 Units for all drawings, specifications, etc. will be based on the metric (SI units) system with the exception of piping which shall use inches NPS.

1.7 EXEPTIONS AND CLARIFICATIONS

.1 All exceptions to these specifications must be clearly indicated. Variations from the tender documents will be considered if they are supported by documents indicating design or delivery improvements offered. It is not intended that the Vendor depart from their standard design and specifications; however, any deviation from this specification shall be noted in the proposal.

1.8 QUALITY ASSURANCE

.1 Components shall be inspected and tested in accordance with the Vendor's standard QC/QA procedures. All Vendor QC/QA procedures are subject to approval by the Contract Administrator.

.2 The Vendor shall supply an inspection test plan with a complete list of tests, exams, reports, and certificates they intend to perform. Cost for all testing and reporting shall be included in the base equipment price.

.3 The Contract Administrator reserves the right to witness any tests or inspections to ensure that components conform to Quality Assurance requirements. The Vendor shall afford free access to manufacturing facilities, including those of their sub-suppliers, for such inspections.

.4 The Vendor shall produce a schedule for manufacturing and testing and shall give the Contract Administrator two weeks' notice of the planned inspections so that the Contract Administrator may dispatch his inspector.

.5 All inspection reports, including non-destructive examinations, chemical analysis, mechanical properties, hardness testing, material certificates, dimensional checking and functional testing, may be requested formally by the Contract Administrator as part of the project's submittals. All inspection reports are subject to Contract Administrator approval. All defects in excess of agreed acceptance criteria shall be reported to the Contract Administrator by the Vendor and evaluated by the Vendor's engineering department for possible corrective actions. All corrections proposed shall be subject to the Contract Administrator's approval and shall be to the account of the Vendor.

.6 The Vendor shall notify the Contract Administrator of any conflicts arising in the interpretation of this specification, the purchase order, drawings or accompanying information. No deviations shall be made from any of the above documentation without prior written approval from the Contract Administrator.

.7 Prior to shipment, components within transportation limits shall be shop assembled and motor-driven components shall be turned electrically. The actual job motor shall be used for the test.

.8 Prior to disassembly and packing for transport, all parts shall be match marked to facilitate field erection. Motor and fan shafts shall be blocked prior to dispatch to avoid brinelling of bearings during transport.

.9 Disassembly shall be into the largest components or sub-assemblies possible, consistent with packing, road transport and handling limitations.

1.9 PERFOMANCE REQUIREMENTS

.1 Guarantee

.1 The Vendor shall guarantee that the equipment offered will meet the requirements specified in this specification and the schedule under site conditions.

.2 The equipment specified is based upon anticipated conditions, calculated on the information available. The Vendor shall examine the data enclosed and confirm that the proposed equipment is capable of meeting the operation requirements.

.3 All values in the specification and the equipment schedules should be rated for the site conditions.

.2 Dimensions

.1 Duct dimensions shown on the drawings are inside sizes. Ducts lined with insulation, shall be increased in size as required to maintain specified internal dimensions.

PART 2 PRODUCTS

2.1 GENERAL

.1 The exhaust fan units shall be factory assembled, balanced, and tested prior to shipping. Unit shall be ready for operation after field installation and connections of the Contract Administrator's supplied ductwork, power and remote controls.

.2 Materials and equipment shall be standard products of established manufacturers who have produced continuously the type of equipment suitable for the conditions specified. All materials and equipment shall be new and of high quality insuring long life and reliable operation. All components shall be standardized whenever possible to minimize the necessary spare parts inventory.

2.2 SERVICE CONDITIONS

.1 Unless otherwise noted in the equipment schedules, exhaust fans will be installed outdoors on the roof of the project facilities. The outdoor conditions are covered in the site conditions spec 02 22 10.01. The exhaust fans air stream will be subjected to the indoor area outlined in site conditions spec 02 22 10.01.

2.3 DESIGN LIFE

.1 The equipment shall be suitable for continuous, heavy duty service 24 hours per day, 365 days per year for minimum operation of 20 years. The equipment shall be of the best quality materials and workmanship available, suitable for these applications with a minimal requirement for maintenance and repair.

2.4 FLEXIBLE DUCT CONNECTIONS

.1 Fan shall be attached to the discharge panel by a heavy neoprene impregnated glass fabric, with double locking fabric to fan connection to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A.

2.5 EXHAUST FAN

.1 General Description:

- .1 Downblast fan shall be for roof mounted applications.
- .2 Maximum continuous operating temperature is 180 Fahrenheit (82.2 Celsius).
- .3 Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.
- .4 Stainless steel fastener only while in air stream. Corrosion resistant fasteners while outside of the air stream.

.2 Wheel:

- .1 Constructed of Solid corrosion resistant molded vinylester resin fiberglass formed as one piece.
- .2 Wheel shall include a precision machined aluminum hub encapsulated in resin such that it is not exposed to the air stream.
- .3 Non-overloading, backward inclined centrifugal.
- .4 Statically and dynamically balanced in accordance to AMCA Standard 204-05
- .5 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

.3 Motors:

- .1 Motor enclosures: Totally Enclosed NEMA Design B with Class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.
- .2 Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
- .3 Mounted on vibration isolators, out of the airstream
- .4 For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants
- .5 Bearings shall be designed and individually tested specifically for use in air handling applications.
- .6 Construction shall be heavy duty re-greaseable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 250,000 hours at maximum cataloged operating speed. Accessible for maintenance

.4 Housing:

- .1 Motor cover, shroud, curb cap, and lower windband shall be constructed of corrosion resistant fiberglass from polyester resin.
- .2 Shroud shall direct air downward

.3 All housing components shall have final thicknesses equal to or greater then preformed thickness.

.4 Curb cap shall have pre-punched mounting holes to ensure correct attachment

.5 Rigid internal support structure

.6 Leak proof

.5 Housing Supports and Drive Frame:

.1 Drive frame assemblies shall be constructed of corrosion resistant fiberglass from polyester resin and mounted on vibration isolators

.6 Vibration Isolation:

.1 Rubber isolators

.2 Sized to match the weight of each fan

.7 Birdscreen:

.1 Material Type: Stainless Steel.

.2 Protects fan discharge.

.8 Roof Curb:

.1 Mounted onto roof with fan.

.2 Material: Galvanized.

.3 Insulation thickness: 1.5 inches.

.4 Protects fan discharge

.9 Backdraft Damper

.1 Material Fiber Reinforced Polymer

.2 Gravity backdraft installed in roof curb

.10 Variable Frequency Drive (VFD)

.1 A VFD shall be provided with the exhaust fans as indicated in the equipment schedule.

.2 VFDs shall be ACS225 drives or approved equal as per B7.

.11 Fans shall be model FCE-B as manufactured by COOK Fan Corporation or approved equal in accordance with B7.

PART 3 EXECUTION

3.1 IDENTIFICATION AND TAGGING

.1 All identification and tagging of equipment and instrumentation shall conform to the Contract Administrator’s standards specified in this purchase inquiry.

3.2 FABRICATION

.1 Air handling units shall be skid mounted and pre-assembled to as maximum extent as possible. All instrumentation shall be pre-wired to junction boxes. All instrumentation sensing lines shall be pre-wired and identified for the mounting of field devices.

3.3 TESTING AND INSPECTION

.1 Air handling units shall be fully factory assembled and tested prior to shipment. Factory testing shall also include vibration amplitude measurement and testing at the factory.

3.4 SHIPPING PREPERATIONS

.1 Refer to procurement documents for details.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL CONDITIONS

.1 Section Includes:

.1 Materials and specifications of supply fans

1.2 REFERENCES

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

.1 ANSI/AMCA Standard 99-2010, Standards Handbook.

.2 ANSI/ASHRAE 51-07 (ANSI/AMCA 210-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.1 MPI #18, Primer, Zinc Rich, Organic.

1.3 RELATED SECTIONS

.1 The following list includes specific items of work related to the air distribution systems which are to be provided under other sections:

.1	Testing, Adjusting, and Balancing for HVAC	Section 23 05 93
.2	Electric and Electric Control Systems for HVAC	Section 23 09 33
.3	Site Conditions	Section 02 22 10.01

1.4 SUBMITTALS

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

.2 General Requirements

.1 Electronic copies of general arrangement drawings as AutoCAD files shall be included.

.2 All equipment shall be identified by the Contract Administrator-assigned equipment numbers.

.3 Technical Information to be included with bid.

.1 In addition to the requirements of the commercial documentation, the Vendor shall include with their Bid the following documents:

.1 Complete scope of supply identifying all components included.

.2 Drawings and documents fully describing/illustrating:

.1 General arrangement and section drawings with physical dimensions and weights of the equipment and ancillaries specified

.2 All necessary clearances around the equipment for operation and maintenance

.3 Complete list of package components with overall dimensions and weights

.4 Preliminary load data (static and dynamic) for foundation / support design

.5 Electrical loads

.6 Instrument list

.7 Description of control system

.8 Installation list for comparable equipment.

1.5 UNIT OF MEASUREMENT

.1 Units for all drawings, specifications, etc. will be based on the metric (SI units) system with the exception of piping which shall use inches NPS.

1.6 EXCEPTIONS AND CLARIFICATIONS

.1 All exceptions to these specifications must be clearly indicated. Variations from the tender documents will be considered if they are supported by documents indicating design or delivery improvements offered. It is not intended that the Vendor depart from their standard design and specifications; however, any deviation from this specification shall be noted in the proposal.

1.7 QUALITY ASSURANCE

.1 Components shall be inspected and tested in accordance with the Vendor's standard QC/QA procedures. All Vendor QC/QA procedures are subject to approval by the Contract Administrator.

.2 The Vendor shall supply an inspection test plan with a complete list of tests, exams, reports, and certificates they intend to perform. Cost for all testing and reporting shall be included in the base equipment price.

.3 The Contract Administrator reserves the right to witness any tests or inspections to ensure that components conform to Quality Assurance requirements. The Vendor shall afford free access to manufacturing facilities, including those of their sub-suppliers, for such inspections.

.4 The Vendor shall produce a schedule for manufacturing and testing and shall give the Contract Administrator two weeks' notice of the planned inspections so that the Contract Administrator may dispatch his inspector.

.5 All inspection reports, including non-destructive examinations, chemical analysis, mechanical properties, hardness testing, material certificates, dimensional checking and functional testing, may be requested formally by the Contract Administrator as part of the project's submittals. All inspection reports are subject to Contract Administrator approval. All defects in excess of agreed acceptance criteria shall be reported to the

Contract Administrator by the Vendor and evaluated by the Vendor's engineering department for possible corrective actions. All corrections proposed shall be subject to the Contract Administrator's approval and shall be to the account of the Vendor.

.6 The Vendor shall notify the Contract Administrator of any conflicts arising in the interpretation of this specification, the purchase order, drawings or accompanying information. No deviations shall be made from any of the above documentation without prior written approval from the Contract Administrator.

.7 Prior to shipment, components within transportation limits shall be shop assembled and motor-driven components shall be turned electrically. The actual job motor shall be used for the test.

.8 Prior to disassembly and packing for transport, all parts shall be match marked to facilitate field erection. Motor and fan shafts shall be blocked prior to dispatch to avoid brinelling of bearings during transport.

.9 Disassembly shall be into the largest components or sub-assemblies possible, consistent with packing, road transport and handling limitations.

1.8 PERFOMANCE REQUIREMENTS

.1 Guarantee

.1 The Vendor shall guarantee that the equipment offered will meet the requirements specified in this specification and the schedule under site conditions.

.2 The equipment specified is based upon anticipated conditions, calculated on the information available. The Vendor shall examine the data enclosed and confirm that the proposed equipment is capable of meeting the operation requirements.

.3 All values in the specification and the equipment schedules should be rated for the site conditions.

.2 Dimensions

.1 Duct dimensions shown on the drawings are inside sizes. Ducts lined with insulation, shall be increased in size as required to maintain specified internal dimensions.

PART 2 PRODUCTS

2.1 GENERAL

.1 The supply fan units shall be factory assembled, balanced, and tested prior to shipping. Unit shall be ready for operation after field installation and connections of the Contract Administrator's supplied ductwork, power and remote controls.

.2 Materials and equipment shall be standard products of established manufacturers who have produced continuously the type of equipment suitable for the conditions specified. All materials and equipment shall be new and of high quality insuring long life and reliable operation. All components shall be standardized whenever possible to minimize the necessary spare parts inventory.

2.2 SERVICE CONDITIONS

.1 Unless otherwise noted in the equipment schedules, supply fans will be installed within the supply ducting of the project facilities. The supply fans air stream will be subjected to the indoor area outlined in site conditions spec 02 22 10.01.

2.3 DESIGN LIFE

.1 The equipment shall be suitable for continuous, heavy duty service 24 hours per day, 365 days per year for minimum operation of 20 years. The equipment shall be of the best quality materials and workmanship available, suitable for these applications with a minimal requirement for maintenance and repair.

2.4 FLEXIBLE DUCT CONNECTIONS

.1 Fan shall be attached to the discharge panel by a heavy neoprene impregnated glass fabric, with double locking fabric to fan connection to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A.

2.5 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210.

2.6 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct drive.

.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

.3 General Description:

.1 Maximum continuous operating temperature is 180 Fahrenheit (82.2 Celsius).

.2 Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

.4 Wheel:

.1 Wheel shall be a precision machined aluminum or composite construction.

.2 Non-overloading, backward inclined centrifugal.

.3 Statically and dynamically balanced in accordance to AMCA Standard 204-05

.4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

.5 Motors:

.1 Motor enclosures: Totally Enclosed NEMA Design B with Class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.

.2 Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.

.3 Construction shall be heavy duty re-greaseable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 250,000 hours at maximum cataloged operating speed. Accessible for maintenance.

.6 Housing:

.1 Motor cover shall be constructed of galvanized steel.

.2 All housing components shall have final thicknesses equal to or greater then preformed thickness.

.7 Fans shall be model SQ as manufactured by Greenheck or approved equal in accordance with B7.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fans installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Contract Administrator.

.2 Inform Contract Administrator 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 Contract Administrator.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings, flexible electrical leads and flexible connections.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 IDENTIFICATION AND TAGGING

.1 All identification and tagging of equipment and instrumentation shall conform to the Contract Administrator’s standards specified in this purchase inquiry.

3.4 SHIPPING PREPERATIONS

.1 Refer to procurement documents for details.

3.5 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL CONDITIONS

.1 Section Includes:

.1 Materials and specifications of exhaust fans

1.2 REFERENCES

.1 All equipment and piping shall be designed and manufactured in accordance with the following applicable current recommendations and standards:

.1 ASME American Society of Mechanical Engineers
.2 ASTM American Society for Testing and Materials
.3 ANSI American National Standards Institute
.4 AMCA Air Movement & Control Association
.5 IEEE Institute of Electrical and Electronics Engineers
.6 CEC Canadian Electric Code
.7 CSA Canadian Standards Association
.8 AHRI Air-Conditioning, Heating, and Refrigeration Institute
.9 NFPA National Fire protection Association
.10 ISA International Society of Automation
.11 ISO International Organization for Standardization
.12 NEMA National Electrical Manufacturers association
.13 ULC Underwriters Laboratories Canada

.2 In addition to the latest revision of the codes and standards contained in the above, work shall conform to any applicable Federal, Provincial and Municipal codes and regulations. In the event of conflict between the referenced codes and standards, drawings, specifications, data sheets, and/or the Purchase Order, Vendor shall obtain clarification before proceeding with the work

1.3 WORK INCLUDED

.1 Detail engineering of the exhaust fans.

.1 Supply all components for a complete and functional unit.
.2 Shipping of material and equipment.
.3 Provide all assembly/manufacturers' instructions and manuals required for installation and to make the units operational.
.4 Factory run testing of the unit prior to shipping, with test report. Factory testing shall also include vibration amplitude measurement and balancing and testing at the factory.
.5 Provide list of suggested critical and commissioning spares parts with associated costs.
.6 Provide specifications sheets and drawings of the units for approval prior to fabrication.

.7 Include with your proposal the milestones (after contract awarded) for:

.1 Shop drawings for approval

.2 Certified drawings

.3 Shop inspection and testing date

.4 Package shipping date

.2 The Work described herein shall be performed in accordance with the Specifications, Design Standards, Datasheets and Drawings provided as part of the Contract Documents and shall govern and amplify, as applicable, the requirements of workmanship, design, construction, and general execution of the Work.

1.4 RELATED SECTIONS

.1 The following list includes specific items of work related to the air distribution systems which are to be provided under other sections:

.1	Testing, Adjusting, and Balancing for HVAC	Section 23 05 93
.2	Electric and Electric Control Systems for HVAC	Section 23 09 33
.3	Site Conditions	Section 02 22 10.01

1.5 SUBMITTALS

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

.2 General Requirements

.1 Electronic copies of general arrangement drawings as AutoCAD files shall be included

.2 All equipment shall be identified by the City-assigned equipment numbers.

.3 Technical Information to be included with bid

.1 In addition to the requirements of the commercial documentation, the Vendor shall include with their Bid the following documents:

.1 Complete scope of supply identifying all components included.

.2 Drawings and documents fully describing/illustrating:

.1 General arrangement and section drawings with physical dimensions and weights of the equipment and ancillaries specified

.2 Fan performance curve

.3 All necessary clearances around the equipment for operation and maintenance

.4 Complete list of package components with overall dimensions and weights

.5 Preliminary load data (static and dynamic) for foundation / support design

.6 Electrical loads

.7 Instrument list

.8 Description of control system

.9 Installation list for comparable equipment.

1.6 UNIT OF MEASUREMENT

.1 Units for all drawings, specifications, etc. will be based on the metric (SI units) system with the exception of piping which shall use inches NPS.

1.7 EXEPTIONS AND CLARIFICATIONS

.1 All exceptions to these specifications must be clearly indicated. Variations from the tender documents will be considered if they are supported by documents indicating design or delivery improvements offered. It is not intended that the Vendor depart from their standard design and specifications; however, any deviation from this specification shall be noted in the proposal.

1.8 QUALITY ASSURANCE

.1 Components shall be inspected and tested in accordance with the Vendor's standard QC/QA procedures. All Vendor QC/QA procedures are subject to approval by the City.

.2 The Vendor shall supply an inspection test plan with a complete list of tests, exams, reports, and certificates they intend to perform. Cost for all testing and reporting shall be included in the base equipment price.

.3 The City reserves the right to witness any tests or inspections to ensure that components conform to Quality Assurance requirements. The Vendor shall afford free access to manufacturing facilities, including those of their sub-suppliers, for such inspections.

.4 The Vendor shall produce a schedule for manufacturing and testing and shall give the City two weeks' notice of the planned inspections so that the City may dispatch his inspector.

.5 All inspection reports, including non-destructive examinations, chemical analysis, mechanical properties, hardness testing, material certificates, dimensional checking and functional testing, may be requested formally by the City as part of the project's submittals. All inspection reports are subject to City approval. All defects in excess of agreed acceptance criteria shall be reported to the City by the Vendor and evaluated by the Vendor's engineering department for possible corrective actions. All corrections proposed shall be subject to the City's approval and shall be to the account of the Vendor.

.6 The Vendor shall notify the City of any conflicts arising in the interpretation of this specification, the purchase order, drawings or accompanying information. No deviations shall be made from any of the above documentation without prior written approval from the City.

.7 Prior to shipment, components within transportation limits shall be shop assembled and motor-driven components shall be turned electrically. The actual job motor shall be used for the test.

.8 Prior to disassembly and packing for transport, all parts shall be match marked to facilitate field erection. Motor and fan shafts shall be blocked prior to dispatch to avoid brinelling of bearings during transport.

.9 Disassembly shall be into the largest components or sub-assemblies possible, consistent with packing, road transport and handling limitations.

1.9 PERFOMANCE REQUIREMENTS

.1 Guarantee

.1 The Vendor shall guarantee that the equipment offered will meet the requirements specified in this specification and the schedule under site conditions.

.2 The equipment specified is based upon anticipated conditions, calculated on the information available. The Vendor shall examine the data enclosed and confirm that the proposed equipment is capable of meeting the operation requirements.

.3 All values in the specification and the equipment schedules should be rated for the site conditions.

.2 Dimensions

.1 Duct dimensions shown on the drawings are inside sizes. Ducts lined with insulation, shall be increased in size as required to maintain specified internal dimensions.

PART 2 PRODUCTS

2.1 GENERAL

.1 The exhaust fan units shall be factory assembled, balanced, and tested prior to shipping. Unit shall be ready for operation after field installation and connections of the City's supplied ductwork, power and remote controls.

.2 Materials and equipment shall be standard products of established manufacturers who have produced continuously the type of equipment suitable for the conditions specified. All materials and equipment shall be new and of high quality insuring long life and reliable operation. All components shall be standardized whenever possible to minimize the necessary spare parts inventory.

2.2 SERVICE CONDITIONS

.1 Unless otherwise noted in the equipment schedules, exhaust fans will be installed outdoors on the roof of the project facilities. The outdoor conditions are covered in the site conditions spec 02 22 10.01. The exhaust fans air stream will be subjected to the indoor area outlined in site conditions spec 02 22 10.01.

2.3 DESIGN LIFE

.1 The equipment shall be suitable for continuous, heavy duty service 24 hours per day, 365 days per year for minimum operation of 20 years. The equipment shall be of the best

.2 quality materials and workmanship available, suitable for these applications with a minimal requirement for maintenance and repair.

2.4 FLEXIBLE DUCT CONNECTIONS

.1 Fan shall be attached to the discharge panel by a heavy neoprene impregnated glass fabric, with double locking fabric to fan connection to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A.

2.5 EXHAUST FAN

.1 General Description:

.1 Fan shall be for roof mounted applications.

.2 Maximum continuous operating temperature is 180 Fahrenheit (82.2 Celsius).

.3 Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

.4 Stainless steel fastener only while in air stream. Corrosion resistant fasteners while outside of the air stream.

.2 Wheel:

.1 Constructed of fiberglass reinforced plastic centrifugal wheel, with strapped in blades

.2 Non-overloading, backward curved centrifugal.

.3 Statically and dynamically balanced in accordance to AMCA Standard 204-05

.4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

.3 Motors:

.1 Motor enclosures: Totally Enclosed NEMA Design B with Class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.

.2 Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.

.3 Mounted on vibration isolators, out of the airstream

.4 For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants

.5 Bearings shall be designed and individually tested specifically for use in air handling applications.

.6 Construction shall be heavy duty self-aligning ball or roller type in a cast iron pillow block housing selected for a minimum L10 life in excess of 80,000 hours at maximum cataloged operating speed. Accessible for maintenance

.7 The motor shall be EC type that uses AC input power and internally converts it to DC power. Motor accepts a 0-10VDC control signal along with a 115V source to power controls in the motor.

.8 Motors shall feature a soft-start and inherent thermal and current protection built into each unit.

.4 Housing:

.1 Motor cover, shroud, curb cap, and lower windband shall be constructed of corrosion resistant fiberglass from polyester resin.

.2 Shroud shall direct air upward

.3 All housing components shall have final thicknesses equal to or greater then preformed thickness.

.4 Curb cap shall have pre-punched mounting holes to ensure correct attachment

.5 Rigid internal support structure

.6 Leak proof

.5 Housing Supports and Drive Frame:

.1 Drive frame assemblies shall be constructed of corrosion resistant fiberglass from polyester resin and mounted on vibration isolators

.6 Vibration Isolation:

.1 Rubber isolators

.2 Sized to match the weight of each fan

.7 Birdscreen:

.1 Material Type: Stainless Steel.

.2 Protects fan discharge.

.8 Backdraft Damper

.1 Material Fiber Reinforced Polymer

.2 Motorized damper installed in connecting ductwork

.9 Fan Speed Control (Hurst, McPhillips):

.1 AC to DC converter

.2 Potentiometer (dial) mounted on the fan housing to adjust the speed (RPM) down up to 80%.

.3 Approved Equipment: Vari-Green or approved equal as per B7.

.10 Fan Speed Control (Maclean):

.1 Variable Frequency Driver (VFD)

.11 Approved Equipment: ABB ACH580 or approved equal as per B7.Fans shall be model 6-BCSW-FRP-10-I-4 as manufactured by Greenheck Corporation or approved equal in accordance with B7.

PART 3 EXECUTION

3.1 IDENTIFICATION AND TAGGING

.1 All identification and tagging of equipment and instrumentation shall conform to the City's standards specified in this purchase inquiry.

3.2 FABRICATION

.1 Fans shall be skid mounted and pre-assembled to as maximum extent as possible. All instrumentation shall be pre-wired to junction boxes. All instrumentation sensing lines shall be pre-wired and identified for the mounting of field devices.

3.3 TESTING AND INSPECTION

.1 Fans shall be fully factory assembled and tested prior to shipment. Factory testing shall also include vibration amplitude measurement and testing at the factory.

3.4 SHIPPING PREPERATIONS

.1 Refer to procurement documents for details.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/ASME B16.1-05, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ANSI B18.2.1-96(R2005), Square and Hex Bolts and Screws - Inch Series.

.3 ANSI B18.2.2-87(R1999), Square and Hex Nuts (Inch Series).

.2 American Society for Testing and Materials (ASTM International)

.1 ASTM C581-20, Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service.

.2 ASTM D3982-21, Standard Specification for Contact Molded “Fiberglass” (Glass Fiber Reinforced Thermosetting Resin) Ducts.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-41.22-93, Fibreglass-Reinforced Plastic Corrosion-Resistant Equipment.

.4 CSA Group (CSA)

.1 CSA-B137 Series-05, Thermoplastic Pressure Piping Compendium (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

1.2 RELATED WORK

.1 Section 23 33 00 – Air Duct Accessories

.2 Section 23 07 13– Duct Insulation

.3 Section 07 84 00 – Fire Stopping

1.3 SUBMITTALS

.1 Submit shop drawings, product data and samples in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FRP DUCTWORK

.1 General:

.1 Piping, fittings, flanges, flange gaskets, primer, cement to be product of one manufacturer.

.2 Fiber Reinforced Polymer (FRP): to ASTM D3982. Type I laminate to be used as per SMACNA.

.3 Fabricate from FRP sheets, to following thicknesses:

Largest dimension (round or rectangular)	Wall thickness (mm)
Up to 750 mm	3.53 mm
751 to 1200 mm	4.62 mm
Above 1200	5.72 mm

.4 Construction standard:

.1 Construction to be to SMACNA "Thermoset FRP Duct Construction Manual" except where specified otherwise herein.

.2 Maximum operating static pressure: 1,000Pa.

.5 Straight ductwork contact molded with interior corrosion barrier layer of a minimum of 2 plies as per SMACNA.

.6 Round ductwork:

.1 Moulded to form perfect round shape within tolerances specified in standard.

.7 Sections and fittings:

.1 Connected by either socket or butt and wrap methods.

.2 Integrated type II flange as per SMACNA with Fluoroelastomer full face seals as per SMACNA allowed as alternative.

.8 Fittings:

.1 Round elbows: centreline radius at least 1.5 x diameter.

.2 Branches, connections to main ducts: at 45 degrees to main duct.

.3 Reducers, round-to-rectangular transformations: Minimum taper 3:1 length: change in diameter.

.4 Offsets: 45 degrees to centreline of straight duct.

.9 Flanges:

.1 Welded to ducts or integrated where indicated and elsewhere as required for cleaning or access to interior of ducting.

.2 Type II construction according to Thermoset FRP Duct Construction Manual.

.3 Gaskets:

.1 minimum 3 mm thickness for up to 610 mm diameter, 5 mm thickness for over 610 mm diameter.

.2 Fluoroelastomer material required.

.4 Flange bolts, nuts and washers: type 316 stainless steel.

.10 Important notice: No metals to penetrate duct system.

.11 Supports, hangers:

.1 All supports to have a maximum support span of 3050 mm. Use properly designed hangers with a minimum of 150° circumferential contact (for round duct) and 51mm minimum longitudinal contact.

.2 Vertical ducts: steel split rings welded to steel brackets and connected by FRP girth strap secured to duct with resin. Rings not to compress duct when closed.

.1 Vertical guides: steel split rings welded to steel brackets but not connected by FRP girth strap secured to duct with resin. Rings not to compress duct when closed.

.3 Horizontal ducts: steel split rings and rod hangers or cradle support. Rings not to compress duct when closed.

.1 Elastomer cushion required between cradle and duct.

.2 PTFE sliding surfaces to be included as indicated.

.4 Use stainless steel for supports and hangers in locations exposed to a corrosive atmosphere.

.5 Ducts shall also be supported independently at hoods, fans, tanks, or other equipment and on both sides of an expansion or flexible joint.

.12 Drains:

.1 Install at lowest point in system.

.2 FRP drain pocket with 25 mm FRP pipe connection.

.3 All connections to be threaded.

.13 Expansion joints:

.1 Expansion joints shall be located where shown on the project drawings.

.2 All expansion joints shall be constructed in accordance with the requirements of SMACNA standards or equivalent.

.3 Ducts shall also be supported independently on both sides of an expansion or flexible joint.

.4 Approved Materials include:

.1 Fiber Reinforced Polymer (FRP)

.2 Fluoroelastomer

.14 Gravity back-draft dampers:

.1 Gravity back-draft dampers shall be located where shown on the project drawings.

.2 Gravity back draft dampers shall be constructed in accordance with the requirements of SMACNA standards or equivalent.

2.2 INSULATION

.1 Insulation to follow Section 23 07 13 – Duct Insulation.

2.3 FIRE STOPPING

.1 Fire stopping to follow section 07 84 00 - Fire Stopping.

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 OF FRP DUCTWORK

.1 In accordance with ASHRAE and SMACNA.

.2 Hangers: complete with locking nuts and washers.

.3 For outdoor applications, the application of a suitable UV and weather resistant paint or coating will be added to the outermost layer.

.4 Installation to occur above freezing and below 18°C ambient temperature for all ducting located outdoors.

.5 Support spacing:

- .1 Vertical ducts: to SMACNA, and at every floor and at roof.
- .2 Horizontal ducts: to SMACNA, and after elbows transitioning from vertical to horizontal.
- .3 Supports:
  - .1 Support heavy accessories independently from adjacent ductwork.
  - .2 Support expansion joints on both sides of joint. The lower support shall be a guild support as per SMACNA.

.6 Joints:

- .1 Weld throughout except at flanges and unions.
- .2 Threaded joints not permitted.
- .3 Make joints in accordance with SMACNA butt–and–wrap, socket, flange, and to manufacturer's recommendations.
- .4 Make connections to other materials or fittings using appropriate adapters and to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.18- M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.

.3 Underwriters' Laboratories of Canada

.1 ULC -S111- 07, "Fire Tests for Air Filter Units".

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

1.5 EXTRA MATERIALS

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Contract Administrator, supply 1 complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50 degrees C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

2.2 ACCESSORIES

.1 Holding frames: permanent channel section construction of extruded aluminum, 1.6 mm thick, except where specified otherwise.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side.

.5 Acceptable material: AAF SurePleat Side Access Filter Housing, or approved equal in accordance with B7.

2.3 EXPANDED MESH FILTERS

.1 Material: Aluminum or Stainless steel

.2 Holding Frame: Heavy gauge

.3 Fire Rated: to ULC -S111.

.4 High Velocity Capability between 150fpm and 900fpm

.5 Nominal thickness: 100mm

.6 Acceptable material: Industrial EZ Kleen 2” Industrial Filter or approved equal in accordance with B7.

2.4 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18.

.2 Holding frame: galvanized steel or slide in channel for side access.

.3 Performance:

.1 MERV 8 to ASHRAE 52.2.

.4 Fire Rated: to ULC -S111.

.5 Nominal thickness: 100 mm.

.6 Acceptable material: PerfectPleat 4” HC M8, or approved equal in accordance with B7.

2.5 FILTER GAUGES - DIAL TYPE

.1 Diaphragm actuated, direct reading.

.2 Range: 0 to 2 times initial pressure.

.3 Acceptable material: Dwyer Magnehelic, or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer’s recommendations and with adequate space for access, maintenance and replacement.

3.2 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.3 FILTER GAUGES

.1 Install type as indicated across each filter bank in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Perform all Work required to provide and install the electric duct heaters indicated by the Contract Documents with supplementary items necessary for proper installation.

.2 Refer to Division 26 sections for the following Work:

.1 Power supply wiring from power source to power connection on electric duct heater. Include, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

.2 Interlock wiring between electrically-operated duct heater and field-installed control devices.

.3 Interlock wiring specified as factory-installed in work of this section.

.3 Provide the following as Work of this Section, complying with requirements of Division 26 Sections:

.1 Control wiring between field-installed controls, indicating devices, and electric duct heater control panels.

1.2 REFERENCE STANDARDS

.1 All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

.1 National Fire Protection Association (NFPA) 70

.2 National Electrical Code

.3 ANSI/UL 1996 - Electric Duct Heaters

1.3 QUALITY ASSURANCE

.1 Manufacturer's Qualifications: Firms engaged in manufacture of electric duct heaters, of types and sizes required.

.2 Codes and Standards:

.1 Heater shall be UL approved for zero clearance to combustible surfaces and have a UL/ cUL label.

.2 Provide electrical components for electric duct heaters, which have been listed and labeled by UL.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's data for duct heaters showing dimensions, capacities, ratings, performance characteristics, electrical and control wiring, gages and finishes of materials, and installation instructions.

.2 Submittal data shall consist of drawings showing coil dimensions, construction materials, watt density, ratings and performance including pressure drops on airside.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.4 Wiring Diagrams:

.1 Furnish a separate, complete wiring diagram for each heater.

.2 Diagram shall include recommended supply wire gauges per NEC, and fuse sizes.

.3 Typical wiring diagrams are not acceptable.

.4 Each heater shall be complete with clearly marked power and control terminals.

.5 Control Box:

.1 Verify control panel size, door swing and duct size with contractor supplied ductwork shop drawings prior to submittal, and ordering heaters.

.2 Verify electrical characteristics and control requirements prior to order.

.6 Record Documents:

.1 Manufacturers wiring diagrams detailing electrical connection to duct heaters for wiring for power, signal, and control systems, differentiating clearly between manufacturer-installed wiring and field-installed wiring.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

PART 2 PRODUCTS

2.1 ELECTRIC DUCT HEATER

.1 Duct heaters shall be open coil heaters.

.1 Voltage, size, wattage, control type and control voltage shall be as scheduled on the drawings.

.2 Manufacturer shall be capable of furnishing three-phase heaters. Refer to mechanical schedules.

.3 Heaters shall be UL listed for zero clearance and meet all applicable requirements of the NEC.

.4 Electric duct heaters shall be independently powered.

.2 Type: Heaters shall be of the flanged mount type for duct mounting.

.3 Duct heaters shall be for indoor use only.

.4 Heating Elements: Open coil of resistance wire, 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings. Heating element support structure shall consist of galvanized steel wire formed and constructed to support ceramic bushings through which the heating element passes.

.5 All heating elements shall be made of nickel/chromium resistance wire with ends terminated by means of staking and heliarc welding to machine screws.

.6 Coil Layout: Vertical (air flow horizontal).

.7 Casing Assembly: Flanged type, galvanized-steel frame

.8 Coil terminals shall be stainless steel plated, terminal insulators and bracket bushings shall be of ceramic and securely positioned.

.9 Control Box: Control cabinet shall have a solid cover also of heavy gauge galvanized steel and held in place with hinges and interlocking disconnect switch.

.10 Orientation: Heaters shall be interchangeable for mounting in a horizontal or vertical duct.

.11 Built-in components shall include disconnecting break magnetic contactors, transformer with primary fusing, pressure-type airflow switch set at 0.05" + 0.02" WC all as required by UL, branch circuit fuses per NEC, interlocking disconnect switch and a single terminal block to accept the number, type and size of conductors as required.

.12 Over-Temperature Protection:

.1 Serviceable through electric duct heater without removing heater from duct or unit.

.2 Disk-type, automatic reset, thermal-cutout safety devices for primary over-temperature protection.

.3 Secondary over-temperature protection by built in disc type manually resettable thermal cutouts. These devices must function independently of one another and are not acceptable if series connected in the control circuit wiring.

.4 All duct heaters will require either a fan interlock circuit or an airflow switch. The airflow switch shall be diaphragm operated differential pressure switch to prevent duct heater from operating when there is no air flow.

.13 A disconnecting magnetic control circuit is required.

.14 All wiring, component sizing, component spacing and protective devices within the control cabinet shall be factory installed and comply with NEC and UL standards.

.15 A wiring diagram depicting layout and connections of electrical components within the control cabinet shall be affixed to the inside of the control cabinet cover.

.16 A rating plate label shall be affixed to the exterior of the control cabinet cover which states model number, serial number, volts, amps, phase, frequency, control volts, volt-amps and minimum airflow requirements.

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 Locate, orient, and connect ductwork per AMCA, ASHRAE, and SMACNA guidelines. Provide service clearances as indicated on the plans. Locate units distant from sound critical occupancies.

.2 Make power and control connections to CSA C22.2 No.46.

.3 Provide a structurally suitable support as necessary for all units. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

.4 Perform all work required to provide and install the following electric duct heaters indicated by the contract documents with supplementary items necessary for proper installation.

.5 All installation shall be in accordance with manufacturer’s published recommendations.

.6 Inspect areas and conditions under which heater units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

.7 Do not operate electric heaters for any purpose until ductwork is clean of any possible debris.

.8 Maintain minimum working clearances around the heater electrical panel in accordance with NEC Article 110.

.9 Install duct heaters in metal ducts and casings constructed according to SMACNA "HVAC Duct Construction Standards".

.10 If applicable, anchor duct heaters in position using suitable supports.

.11 Connect duct heaters and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer’s published torque-tightening values for equipment connectors. Where manufacturer’s torque requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL 486A.

.12 After construction is completed, including painting, clean unit's exposed surfaces and vacuum clean electric duct heaters and inside of cabinets.

3.3 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL CONDITIONS

.1 This specification outlines the minimum requirements and covers the furnishing of all labour, material, equipment and services for the design, manufacture, and testing and supply of air handling units for the City of Winnipeg Regional Pumping Stations, Hurst, MacLean, and McPhillips.

.2 The equipment shall be self-contained, factory assembled, tested and delivered, ready for field installation.

1.2 INCLUDED IN SCOPE

.1 The following is included in the scope of supply:

- .1 Casing with insulation
- .2 Access doors for each unit section
- .3 Fan(s)
- .4 Electric motor and drive, motor starter and controls
- .5 Electric heating coils and associated electrical controls
- .6 Air filters
- .7 Motorized dampers
- .8 All necessary wiring internal to the unit
- .9 Unit control panels
- .10 Temperature sensors and all other field instruments and miscellaneous components required for an air handling unit automatic operation
- .11 Structural steel base
- .12 Special tools required for erection and maintenance.

.2 Refer to Equipment Schedule for detailed specification requirements for each individual unit.

.3 Detail engineering of the air handling units

- .1 Supply all components for a complete and functional unit.
- .2 Shipping of material and equipment.
- .3 Provide all assembly/manufacturers' instructions and manuals required for installation and to make the units operational.
- .4 Factory run testing of the unit prior to shipping, with test report. Factory testing shall also include vibration amplitude measurement and balancing and testing at the factory.
- .5 Provide list of suggested critical and commissioning spares parts with associated costs.
- .6 Provide specifications sheets and drawings of the units for approval prior to fabrication.

.7 Include with your proposal the milestones (after contract awarded) for:

.1 Shop drawings for approval

.2 Certified drawings

.3 Shop inspection and testing date

.4 Package shipping date

.4 The Work described herein shall be performed in accordance with the Specifications, Design Standards, Datasheets and Drawings provided as part of the Contract Documents and shall govern and amplify, as applicable, the requirements of workmanship, design, construction, and general execution of the Work.

1.3 NOT INCLUDED IN THE SCOPE

.1 The following is not included in the scope of supply:

.1 Installation labor and off-loading at site

.2 Foundations including bolts

.3 Electrical wiring and conduits external to and not forming an integral part of the equipment and auxiliary systems

.4 Electrical power supply Ductwork, air distribution dampers, and air outlets

.5 Lubrication other than initial greasing applied during assembly

.6 Commissioning and start-up (except as noted herein).

1.4 REFERENCES

.1 All equipment and piping shall be designed and manufactured in accordance with the following applicable current recommendations and standards:

.1 ASME American Society of Mechanical Engineers

.2 ASTM American Society for Testing and Materials

.3 ANSI American National Standards Institute

.4 AMCA Air Movement & Control Association

.5 IEEE Institute of Electrical and Electronics Engineers

.6 CEC Canadian Electric Code

.7 CSA Canadian Standards Association

.8 AHRI Air-Conditioning, Heating, and Refrigeration Institute

.9 NFPA National Fire protection Association

.10 ISA International Society of Automation

.11 ISO International Organization for Standardization

.12 NEMA National Electrical Manufacturers association

.13 ULC Underwriters Laboratories Canada

.2 In addition to the latest revision of the codes and standards contained in the above, work shall conform to any applicable Federal, Provincial and Municipal codes and regulations. In the event of conflict between the referenced codes and standards, drawings,

specifications, data sheets, and/or the Purchase Order, Vendor shall obtain clarification before proceeding with the work

1.5 RELATED SECTIONS

.1 The following list includes specific items of work related to the air distribution systems which are to be provided under other sections:

.1	Testing, Adjusting, and Balancing for HVAC	Section 23 05 93
.2	Electric and Electric Control Systems for HVAC	Section 23 09 33
.3	Site Conditions	TBD

1.6 SUBMITTALS

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

.2 General Requirements

.1 Electronic copies of general arrangement drawings as AutoCAD files shall be included

.2 All equipment shall be identified by the City standardized equipment numbers indicated in the design package.

.3 Technical Information to be Included with Bid

.1 In addition to the requirements of the commercial documentation, the Vendor shall include with their Bid the following documents:

.1 Completed the Equipment

.2 Complete scope of supply identifying all components included.

.3 Drawings and documents fully describing/illustrating:

.1 General arrangement and section drawings with physical dimensions and weights of the equipment and ancillaries specified

.2 All necessary clearances around the equipment for operation and maintenance

.3 Complete list of package components with overall dimensions and weights

.4 Preliminary load data (static and dynamic) for foundation / support design

.5 Electrical loads

.6 Instrument list

.7 Description of control system

.8 Installation list for comparable equipment.

1.7 UNIT OF MEASUREMENT

.1 Units for all drawings, specifications, etc. will be based on the metric (SI units) system with the exception of piping which shall use inches NPS.

1.8 EXCEPTIONS AND CLARIFICATIONS

.1 All exceptions to these specifications must be clearly indicated. Variations from the tender documents will be considered if they are supported by documents indicating design or delivery improvements offered. It is not intended that the Vendor depart from their standard design and specifications; however, any deviation from this specification shall be noted in the proposal.

1.9 QUALITY ASSURANCE

.1 Packing, shipping, handling and unloading:

.1 Prior to disassembly and packing for transport, all parts shall be match marked to facilitate field erection. Motor and fan shafts shall be blocked prior to dispatch to avoid brinelling of bearings during transport.

.2 Disassembly shall be into the largest components or sub-assemblies possible, consistent with packing, road transport and handling limitations inspection authority.

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

.4 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.10 PERFOMANCE GUARANTEE

.1 The Vendor shall guarantee that the equipment offered will meet the requirements specified in this specification and under site conditions.

.2 The equipment specified is based upon anticipated conditions, calculated on the information available. The Vendor shall examine the data enclosed and confirm that the proposed equipment is capable of meeting the operation requirements.

.3 All values in the specification and the equipment schedule should be rated for the site conditions.

PART 2 PRODUCTS

2.1 GENERAL

.1 The air handling units shall be factory assembled, balanced, and tested prior to shipping. Unit shall be ready for operation after field installation and connections of the City’s supplied ductwork, power and remote controls.

.2 Materials and equipment shall be standard products of established manufacturers who have produced continuously the type of equipment suitable for the conditions specified. All materials and equipment shall be new and of high quality insuring long life and reliable operation. All components shall be standardized whenever possible to minimize the necessary spare parts inventory.

2.2 SERVICE CONDITIONS

.1 Unless otherwise noted, air handling units will be installed outdoors on the roof of the project facilities. The outdoor conditions are covered in the site conditions spec 02 22 10.01.

2.3 DESIGN LIFE

.1 The equipment shall be suitable for continuous, heavy duty service 24 hours per day, 365 days per year for minimum operation of 20 years. The equipment shall be of the best quality materials and workmanship available, suitable for these applications with a minimal requirement for maintenance and repair.

2.4 CERTIFICATION REQUIRMENTS

.1 Air handling unit as a completely packaged equipment shall bear CSA/ULC or ETL approved label.

2.5 CASING

.1 All structural frames, exterior and interior panels shall be constructed of factory standard epoxy painted mild steel and have complete structural frame with removable panels.

.2 Unit casing shall be constructed of galvanized steel with thickness of 1.3mm (18 gauge) minimum.

.3 Provide sufficient floor reinforcement for both live and dead loads. All floor areas shall be insulated on the underside.

.4 The Vendor shall be responsible to provide connection flanges and all other framework that is needed on unit to ensure that removal of unit's panels shall not affect structural integrity. The unit shall be built in maximum 5 m sections. All necessary fasteners and sealants for field assembly of sections shall be provided.

.5 Seal and gasket all joints between exterior panels and structural frames with butyl gasketing for air seal and acoustical break. Continuous high pressure sealer shall be provided between all panels. Caulking is not acceptable.

.6 Unit casing shall be able to withstand up to 1.5 x rated operating pressure with less than 1% air leakage. Maximum casing deflection shall be 1/200 at 1.5 times working pressure.

2.6 ACCESS DOORS

.1 Units shall be provided with full sized hinged access doors to the following components:

.1 Filters section

.2 Electric heating section

.3 Fan section.

.2 Removal of screwed wall panels for access will NOT be acceptable.

.3 Door gasket shall be automotive bulb style neoprene gasketing or equivalent around full perimeter of access doors to prevent air leakage.

.1 Door gasket shall be automotive bulb style neoprene gasketing or equivalent

around full perimeter of access doors to prevent air leakage.

.2 Low density adhesive foam gasketing is NOT acceptable.

.3 Access door hardware shall be Ventlock style non-corrosive alloy cast latches operable from inside or outside of unit. Hinges shall be heavy duty 316 stainless steel piano style or heavy duty pin style of hinges.

.4 Doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in.

.5 If access doors open against unit operating pressure, provide safety latches that allow access doors to partially open after first handle movement and fully open after second handle movement.

.6 Where hinged access doors are inconvenient, removable doors with 4 cam locks will be acceptable.

.7 All access doors shall have 25 mm (1") internal glass fiber insulation.

2.7 BASE SUPPORT

.1 Unit casing shall be supported on a structure steel base support rails, epoxy painted as per factory standards.

.1 External base support rails shall be used for a common base for component sections and anchoring to a housekeeping pad.

.2 External support base rail shall be minimum 150 mm (6“) in height.

.3 Unit plate floor shall be installed on the base and shall be flat reinforced from below, with all seams continuously welded.

.4 Integral lifting lugs shall be provided for hoisting.

.5 Base shall be suitable for concrete floor mounting or steel platform installation.

2.8 FAN SECTION

.1 Fan shall be supplied as per AMCA standard for construction, testing, and AMCA certified rating seal.

.2 Fan shall be centrifugal, with airfoil or backward inclined wheel, double width, double inlet (DWDI). Fan shall be non-overloading design with operating curve to ensure quiet and stable operation under all conditions.

.3 The fan shall provide with electric motor, adjustable motor base, V-belt drive arrangement unless noted otherwise.

.4 Fan shaft shall be solid, ground and polished, carbon steel, SAE 1045 material, machined to close tolerances, keyed to the fan wheel. Fan shaft shall be coated with a rust inhibitor after machining. Hollow shafts are not acceptable.

.5 Fan bearings shall be in self-aligning pillow block, grease lubricated, extra heavy duty antifriction ball or spherical roller type, selected for minimum 100,000 hours of ABMA L-10 bearing life at design operating conditions. Extended stainless steel lubrication line shall be provided to permit lubrication for both bearings to be performed from the access door.

.6 Fan size shall be selected to provide the required design volume at a fan static pressure that is indicative of 60% plugged filters.

.7 Fan shroud shall be continuously welded heavy-duty mild steel construction designed to minimize maintenance time. Cam-lock, or bolted inspection doors with gaskets shall be conveniently placed on the fan scroll casing to allow for wheel inspections, and clearance observations.

.8 Fan shall be attached to the discharge panel by a heavy neoprene impregnated glass fabric, with double locking fabric to metal connection to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A.

.9 Motors shall be heavy-duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of heavy-gauge steel. Motors and drives shall be mounted on vibration isolators, out of the airstream where no steel-to-steel contact between rotating components and the base shall occur. Fresh air for motor cooling shall be drawn into the motor compartment through a ten-square-inch tube free of discharge contaminants. Motors and drives shall be readily accessible for maintenance.

.10 All exposed rotating parts shall be fully enclosed by removable belt and shaft guards to OSHA standards. Guards shall facilitate measuring vibration on bearings.

.11 Belt guard shall be sized to allow either sheave to be increased by two sizes.

2.9 ELECTRIC HEATING SECTION

.1 Include a control panel enclosure heater with separate 120V power connection to main connection.

.2 Completely assembled and factory installed electric heating system shall be integral to the air handling unit. Electric resistance type heaters shall be provided inside the heating section. Heater capacities, voltage and type of control shall be as per following specifications:

.1 No combustible surfaces shall be used for electric air handling equipment.

.2 Heating element shall be finned tubular type, consisting of a coil, 80% nickel, 20% chromium, Grade A resistance wire, precisely centered in a stainless steel tube filled with granular magnesium oxide. Stainless steel fin is to be helically wound onto the tube.

.3 Heater frames and terminal boxes shall be corrosion resistant steel. Unless otherwise indicated, the terminal box shall be minimum NEMA 4 construction and shall be provided with a hinged, latching cover.

.4 Heater element shall be installed a minimum of 300 mm (12”) downstream from air filters. Insulation in heating sections shall be fibre-reinforced foil faced. Should discharge air exceed 40°C (104°F), motors in air stream shall be complete with Class F insulation. Over 65°C (149°F) discharge air temperature, motors shall be mounted out of the heated air stream.

.5 Heater shall be rated for 600V/3Ph/60Hz power. Heater circuits shall have branch circuit fusing.

.6 Heater shall be equipped with step controllers, with an SCR on the last step.

Control of the heater shall be by unit's discharge temperature sensor signal, manually reset. As minimum requirements, the following controls shall be provided for an air handling unit:

.1 SCR control (solid state modulating)

.2 Fuseblocks (one per step unless specified otherwise)

.3 Built-in control transformer

.4 Thermal cut-outs (manual reset disc type, one per circuit)

.5 Elements control (accessible with protection against no air flow, short and grounds, and of self-checking type)

.6 High limit temperature control (de-energize heating elements against overheating).

2.10 MOTORIZED DAMPERS

.1 Supply motorized outdoor air dampers with air handling units as specified. The dampers shall be made as per the following requirements:

.1 Damper blades shall be minimum 1.63 mm galvanized steel or stainless steel double skin airfoil parallel blade design. Damper blades shall be linked exterior to the damper, consisting of stainless steel flat bar welded to each axle and interconnected with main link bar via nylon bushings and non-slip fasteners.

.2 Damper frames shall be made of a heavy galvanized steel channel, rigidly welded to form a sturdy assembly. Frames shall be drilled and fitted with flanged Teflon bushings.

.3 Damper linkages hardware shall be installed in frame out of air-stream.

.4 Damper seals shall be designed for minimum air leakage by means of overlapping seals. Jack shaft assemblies shall be provided for multiple damper installations.

.5 Damper actuators shall be factory installed high torque NEMA 4 minimum electric damper modulating operators to modulate supply air temperature at pre-set value, by supply air temperature controller. The actuators shall be mounted in easily accessible sections of the air handling unit.

.6 Damper actuators shall accept a 4 to 20 mA input and provide a 2 to 10 volt DC position feedback signal. Standard of acceptance: Belimo.

.7 Dampers in outdoor air stream shall be thermally insulated low leakage type, with a thermal break on each blade and suitable for outdoor design temperature of -34°C. Standard of acceptance: Tamco Series 9000 ECT, or approved equal in accordance with B7.

.8 For heating and ventilating units as specified in Control Section 23 09 33.

2.11 AIR FILTER SECTION

.1 Filter section shall be constructed of painted mild steel. Construction and finish shall be the same as unit casings and with following requirement for air filters:

.1 Unless otherwise noted, air filters will be MV EZ Kleen Metal Mesh Filter, 50 mm (2") or approved equal per B7 for open-air filters, and disposable, media panel type, 50 mm (2") pre-filters shall have minimum MERV 8 efficiency based on

ASHRAE Standard 52.2.

.2 Filter media will be fibrous glass blanket, ULC class 2 rating, and factory sprayed with flame retardant, non-drip, non-volatile adhesive. Maximum face velocity shall not exceed 2.5 m/s (500 fpm).

.1 Open-air filter media will be expanded metal mesh meeting UL Class 2, and factory sprayed with flame retardant, non-drip, non-volatile adhesive. Maximum face velocity shall not exceed 2.6 m/s (512 fpm) under normal operation.

.3 Filters mounting shall be permanent, removable 316L stainless steel 50 mm (2") thick frames, with effective open area not less than 95%.

.4 Frames shall have expanded metal grid on leaving air side and steel rod grid on air entering side, hinged with pull and retaining handles.

.5 Filter blank-off plates shall be provided to prevent air bypass around filters.

.6 Factory installed Photohelic filter switch / gauge on each filter section shall be included.

.7 Gauges shall be flush mounted to exterior unit casing. Furnish and install all required interconnecting tubing, isolation valves, fittings, etc. that are required to make an operating system. All tubing, fittings, etc., shall be constructed of 316L stainless steel.

2.12 ELECTRICAL AND CONTROLS

.1 Electrical components shall generally comply with intent of the Electric and Electronic Control Systems for HVAC Section 23 09 33. All electrical controls component and wiring shall be CSA-approved.

.2 Unless specified otherwise, air handling units shall be fed from 600V / 3PH / 60Hz power supply. Each unit shall be provided with a single electrical feed point. Where power is to be utilized at different voltages, the unit shall be provided built-in transformer(s).

.3 Units shall be supplied with NEMA 4 (NEMA 4X as noted for corrosive areas) control panel complete with hinged access door, unit mounted, or remote mounted as specified. The control panel shall include the following as minimum:

.1 Fan motor starters, overload and sub circuit fuses

.2 Disconnect switch

.3 Control circuit transformer

.4 System on green light

.5 Electric "heat on" light indicator

.6 General failure red light via an air proving switch

.7 Contacts for operation status and trouble alarms

.8 Contacts for interlock with fire alarm system.

.4 The air handling unit shall be equipped with the following for external control. Refer to Drawings for details:

.1 External start signal for use of PLC control.

.2 24V DC power supply output to power external control start chain.

.3 External speed control input to adjust speed via PLC system. Speed control shall accept 0-10V.

.5 The Vendor shall provide instrumentation for all necessary monitoring, including but not necessarily limited to:

.1 Unit discharge air temperature sensors and transmitters for damper control / actuation where specified

.2 Remote room temperature sensors or thermostats and/or temperature sensors as specified.

.1 Thermostat shall be supplied with plastic covering suitable for category 2 hazardous environment.

.3 Static pressure differential sensors and transmitters for damper control/actuation where specified

.4 Filter indication photohelic gauges c/w stainless steel 316l tubing and fittings.

.6 The Vendor shall provide complete electrical and control schematic and wiring diagrams.

2.13 SURFACE PREPARATION AND FINISH

.1 Unless noted for component special painting and coating in this specification and the, unit painting and finish shall be per Section 09 91 23.

.2 The Vendor may recommend their standard paint system with due regard for the duty and service as expressed in the equipment schedule. Finish color to be selected by City.

PART 3 EXECUTION

3.1 IDENTIFICATION AND TAGGING

.1 All identification and tagging of equipment and instrumentation shall conform to the City's standards specified in this purchase inquiry.

3.2 FABRICATION

.1 Air handling units shall be skid mounted and pre-assembled to as maximum extent as possible. All instrumentation shall be pre-wired to junction boxes. All instrumentation sensing lines shall be pre-wired and identified for the mounting of field devices.

3.3 TESTING AND INSPECTION

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.2 Provide Contract Administrator with notice 24 hours in advance of commencement of tests.

.3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).

.4 Submit complete report of test results, including sound curves.

3.4 SHIPPING PREPERATIONS

.1 Refer to procurement documents for details.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL CONDITIONS

.1 This specification outlines the minimum requirements and covers the furnishing of all labour, material, equipment and services for the design, manufacture, and testing and supply of toxic chemical scrubbers for the City of Winnipeg Regional Pumping Stations, Hurst, MacLean, and McPhillips.

.2 The equipment shall be self-contained, factory assembled, tested and delivered, ready for field installation.

.3 Systems should be designed and constructed so that the chlorine gas only contacts solid Fiber Reinforced Polymer (FRP) surfaces. All steel fasteners within the corrosive gas contact area shall be encapsulated with a minimum of 3 mm of FRP layup. All shafts within air stream will be fully protected with FRP shaft sleeves.

.4 System must be appropriately designed for outdoor conditions.

.5 Aluminium vessels are not acceptable for chlorine service.

1.2 INCLUDED IN SCOPE

.1 The following is included in the scope of supply:

- .1 Casing with insulation
- .2 Access doors for each unit section
- .3 Fan(s)
- .4 Electric motor and drive, motor starter and controls
- .5 Chlorine Absorption Media
- .6 Motorized dampers
- .7 All necessary wiring internal to the unit
- .8 Unit control panels
- .9 Temperature sensors and all other field instruments and miscellaneous components required for a toxic chemical scrubbers automatic operation
- .10 Special tools required for erection and maintenance.
- .11 Chlorine gas absorbing media.
- .12 Initial filling of toxic chemical scrubbers with media.

.2 Detail engineering of the chlorine removal Unit

- .1 Supply all components for a complete and functional unit.
- .2 Shipping of material and equipment.
- .3 Provide all assembly/manufacturers' instructions and manuals required for installation and to make the units operational.
- .4 Provide list of suggested critical and commissioning spares parts with associated costs.
- .5 One day services for start-up and training services

.6 Provide specifications sheets and drawings of the units for approval prior to fabrication.

.7 First fill of approved absorption media

.8 Lifetime absorption media life analysis

.9 Include with your proposal the milestones (after contract awarded) for:

.1 Shop drawings for approval

.2 Certified drawings

.3 Package shipping date

.3 The Work described herein shall be performed in accordance with the Specifications, Design Standards, Datasheets and Drawings provided as part of the Contract Documents and shall govern and amplify, as applicable, the requirements of workmanship, design, construction, and general execution of the Work.

1.3 NOT INCLUDED IN THE SCOPE

.1 The following is not included in the scope of supply:

.1 Installation labor and off-loading at site

.2 Foundations including bolts

.3 Electrical wiring and conduits external to and not forming an integral part of the equipment and auxiliary systems

.4 Electrical power supply Ductwork, air distribution dampers, and air outlets

.5 Lubrication other than initial greasing applied during assembly

.6 Interior room chlorine sensors

.7 Flex connections at inlet

1.4 REFERENCES

.1 All equipment and piping shall be designed and manufactured in accordance with the following applicable current recommendations and standards:

.1 ASME American Society of Mechanical Engineers

.2 ASTM American Society for Testing and Materials

.3 ANSI American National Standards Institute

.4 AMCA Air Movement & Control Association

.5 IEEE Institute of Electrical and Electronics Engineers

.6 CEC Canadian Electric Code

.7 CSA Canadian Standards Association

.8 NFPA National Fire protection Association

.9 ISA International Society of Automation

.10 ISO International Organization for Standardization

.11 NEMA National Electrical Manufacturers association

.12 ULC Underwriters Laboratories Canada

.13 Chlorine Institute

.14 SMACNA Thermoset Fiber Reinforced Polymer Duct (FRP) Construction Manual

.2 In addition to the latest revision of the codes and standards contained in the above, work shall conform to any applicable Federal, Provincial and Municipal codes and regulations. In the event of conflict between the referenced codes and standards, drawings, specifications, data sheets, and/or the Purchase Order, Vendor shall obtain clarification before proceeding with the work.

1.5 SPARE PARTS

.1 Furnish spare parts (supplied per toxic chemical scrubbers), identical and interchangeable with similar parts installed in Work:

.1 Three (3) sets of spare gaskets (all types).

.2 One (1) set of fan belts.

.3 One (1) duct mounted chlorine gas sensor.

.4 One (1) 136 kg (300 lb) drum of spare media.

.5 One (1) media sampling rod.

.6 Spare parts for the control panel:

.1 Three (3) spare fuses of each type and size.

.2 One (1) spare relay for each coil voltage and size.

.7 Provide all other manufacturer's recommended spare parts necessary to maintain each piece of equipment for period of one (1) year.

.2 All spare parts shall be suitably marked and packaged in protective cartons. All spare parts shall be of same type and quality as the equipment provided for the Work.

.3 The Contract Administrator is to be notified of both delivery and receipt of these spare parts, and a tracking log of items are to be maintained electronically and on-site. Coordinate with the Contract Administrator for a storage location for the spare parts.

1.6 RELATED SECTIONS

.1 The following list includes specific items of work related to the air distribution systems which are to be provided under other sections:

.1	Testing, Adjusting, and Balancing for HVAC	Section 23 05 93
.2	Electric and Electric Control Systems for HVAC	Section 23 09 33
.3	Site Conditions	Section 02 22 10.01

1.7 SUBMITTALS

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

.2 General Requirements

.1 Electronic copies of general arrangement drawings as AutoCAD files shall be included.

.2 All equipment shall be identified by the City-assigned equipment numbers.

.3 Prior to initial submittal, the engineering representative of the equipment vendor shall meet on Site with the Contractor Administrator and the City to conduct a pre-submittal analysis of the designed installation.

.4 Technical Information to be Included with Bid

.1 In addition to the requirements of the commercial documentation, the Vendor shall include with their Bid the following documents:

.1 Completed the Equipment Data Sheets.

.2 Complete scope of supply identifying all components included.

.3 Drawings and documents fully describing/illustrating:

.1 General arrangement and section drawings with physical dimensions and weights of the equipment and ancillaries specified

.2 Fan operational performance curves

.3 All necessary clearances around the equipment for operation and maintenance

.4 Complete list of package components with overall dimensions and weights

.5 Preliminary load data (static and dynamic) for foundation / support design

.6 Electrical loads

.7 Instrument list

.8 Description of control system

.9 Installation list for comparable equipment.

1.8 UNIT OF MEASUREMENT

.1 Units for all drawings, specifications, etc. will be based on the metric (SI units) system with the exception of piping which shall use inches NPS.

1.9 EXEPTIONS AND CLARIFICATIONS

.1 All exceptions to these specifications must be clearly indicated. Variations from the tender documents will be considered if they are supported by documents indicating design or delivery improvements offered. It is not intended that the Vendor depart from their standard design and specifications; however, any deviation from this specification shall be noted in the proposal.

1.10 QUALITY ASSURANCE

.1 Scrubber suppliers shall provide sufficient test data to demonstrate that they have successfully evaluated their full-scale system and its ability to neutralize the entire contents of one (1) overfilled one-ton chlorine container leaking from a fusible plug, as well as release rates of 35.4 kg/min (78 lbs/minute) for thirty (30) minutes or higher. Test data shall include a profile of temperatures and pressures throughout the spill room and scrubber system for the test cycle. Testing shall have been carried out at a fully accredited testing laboratory facility in Canada or the United States (U.S. Council of American Building Officials - (CABO) or equal), with appropriate witnesses.

.2 Test results exhibiting conformance to the Uniform Fire Code regarding emissions shall be made part of the required design submittal for approval prior to release for fabrication. Averaging of test data shall not be acceptable. Any tests carried out at manufacturer's facility will not be considered acceptable. All of the costs associated with compliance to this specification are the responsibility of the scrubber manufacturer. All tests shall have been performed prior to the time of bid.

.3 Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:

.1 Service Technician must have a minimum of five (5) years of experience all within the last seven (7) years, on the type and size of equipment. Service Technician must be present on Site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.

.2 Demonstration: Calibrate, check alignment and perform a demonstration in accordance with Section 01 91 31. Demonstration to include all tests specified. Perform functional testing using ambient air.

.3 Performance Testing: Field performance test equipment specified.

.4 Conduct performance testing of the equipment in accordance with Section 01 91 31.

.4 Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions in accordance with Section 01 78 24.

.5 One (1) person-days (including mobilization, four (4) hours of training, and demobilization).

.6 Components shall be inspected and tested in accordance with the Vendor’s standard QC/QA procedures. All Vendor QC/QA procedures are subject to approval by the City.

.7 The Vendor shall supply an inspection test plan with a complete list of tests, exams, reports, and certificates they intend to perform. Cost for all testing and reporting shall be included in the base equipment price.

.8 The City reserves the right to witness any tests or inspections to ensure that components conform to Quality Assurance requirements. The Vendor shall afford free access to manufacturing facilities, including those of their sub-suppliers, for such inspections.

.9 The Vendor shall produce a schedule for manufacturing and testing and shall give the City two weeks’ notice of the planned inspections so that the City may dispatch his inspector.

.10 All inspection reports, including non-destructive examinations, chemical analysis, mechanical properties, hardness testing, material certificates, dimensional checking and functional testing, may be requested formally by the City as part of the project’s submittals. All inspection reports are subject to the City approval. All defects in excess of agreed acceptance criteria shall be reported to the City by the Vendor and evaluated by the Vendor’s engineering department for possible corrective actions. All corrections proposed shall be subject to the City’s approval and shall be to the account of the Vendor.

.11 The Vendor shall notify the City of any conflicts arising in the interpretation of this specification, the purchase order, drawings or accompanying information. No deviations shall be made from any of the above documentation without prior written approval from the City.

.12 Prior to shipment, components within transportation limits shall be shop assembled and motor-driven components shall be turned electrically. The actual job motor shall be used for the test.

.13 Prior to disassembly and packing for transport, all parts shall be match marked to facilitate field erection. Motor and fan shafts shall be blocked prior to dispatch to avoid brinelling of bearings during transport.

.14 Disassembly shall be into the largest components or sub-assemblies possible, consistent with packing, road transport and handling limitations. inspection authority.

1.11 PERFOMANCE REQUIREMENTS

.1 Guarantee

.1 The Vendor shall guarantee that the equipment offered will meet the requirements specified in this specification and under site conditions.

.2 The equipment specified is based upon anticipated conditions, calculated on the information available. The Vendor shall examine the data enclosed and confirm that the proposed equipment is capable of meeting the operation requirements.

.3 All values in the specification and the equipment schedules should be rated for the site conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable Material: Pure Air Filtration EGS-8, Purafil FOC1, or approved equal in accordance with B7.

2.2 GENERAL

.1 The toxic chemical scrubber shall be ready for operation after field installation and connections of the City’s supplied ductwork, power and remote controls.

.2 Materials and equipment shall be standard products of established manufacturers who have produced continuously the type of equipment suitable for the conditions specified. All materials and equipment shall be new and of high quality insuring long life and reliable operation. All components shall be standardized whenever possible to minimize the necessary spare parts inventory.

.3 The toxic chemical scrubber shall be capable of containing a leak event for one (1) chlorine tonner at a flash release percent of 100 percent.

.4 The toxic chemical scrubber’s minimum ventilation rate should be 2,360L/s (5000cfm) and the external static pressure shall be per the equipment schedule for each station.

.5 The system shall be designed to remove a minimum of 99.99 % of chlorine vapour in a single pass (discharge not to exceed 5 ppm).

.6 The toxic chemical scrubber shall be designed for automatic operation in response to PLC signals for leak detectors or by manual activation.

2.3 SERVICE CONDITIONS

.1 Unless otherwise noted in the equipment schedules, the toxic chemical scrubber will be installed outdoors on a concrete pad adjacent to the project facilities. The outdoor conditions are covered in the site conditions spec 02 22 10.01.

2.4 DESIGN LIFE

The equipment shall be suitable for standby emergency service 24 hours per day, 365 days per year for minimum operation of 20 years. The equipment shall be of the best quality materials and workmanship available, suitable for these applications with a minimal requirement for maintenance and repair.

2.5 CASING

.1 All structural frames, exterior and interior panels shall be constructed of factory standard fiber reinforced polymer. The media screen shall be of an appropriate material and construction to support the specified amount of collection media.

.2 Provide sufficient floor reinforcement for both live and dead loads. All floor areas shall be insulated on the underside.

.3 The Vendor shall be responsible to provide connection flanges and all other framework that is needed on unit to ensure that removal of unit's panels shall not affect structural integrity. All necessary fasteners and sealants for field assembly of sections shall be provided.

.4 Unit casing shall be able to withstand up to 1.5 x rated operating pressure with less than 1% air leakage. Maximum casing deflection shall be 1/200 at 1.5 times working pressure.

.5 Differential pressure gauge to measure pressure through entire media section.

.1 Acceptable material: Dwyer Series 2000 Magnehelic Pressure Gauge, Wika, or approved equal.

.6 Physical size limitations:

.1 Gross Weight: 50,000 lbs.

.2 Maximum Footprint: 5,000 mm x 3,000 mm.

2.6 ACCESS DOORS

.1 Units shall be provided with full sized hinged or bolted access doors to the media storage.

2.7 FAN SECTION

.1 General: Designed and constructed so that the chlorine gas only contacts solid FRP surfaces. All steel fasteners within the corrosive gas contact area shall be encapsulated with a minimum of 3 mm of FRP layup. AMCA arrangements as required by the scrubber manufacturer. All shafts will be fully protected with FRP shaft sleeves. The fan shall be constructed as per AMCA Standards 99.

.2 Fan shall be supplied as per AMCA standard for construction, testing, and AMCA certified rating seal.

.3 Fan shall be centrifugal, with airfoil or backward inclined wheel, double width, double inlet (DWDI). Fan shall be non-overloading design with operating curve to ensure quiet and stable operation under all conditions.

.4 Wheel shall be constructed of fiber reinforced vinylester resin, molded and formed in one solid piece. Wheels constructed of separately molded shroud, floats and backplate and then assembled are considered unacceptable. Wheel shall include a precision machined aluminum hub encapsulated in resin. Wheel inlet shall overlap an aerodynamic inlet cone to provide maximum performance and efficiency.

.5 All fiberglass resin to be formulated to achieve a Class I flame spread below 25. All resin surfaces shall have additional chemical, flame and ultraviolet protective top coating.

.6 Housing and other standard components are of corrosion resistant fiberglass from polyester resin.

.7 The fan shall be provided with electric motor, adjustable motor base, V-belt drive arrangement unless noted otherwise in the equipment schedules.

.8 Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150 percent of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

.9 Fan shaft shall be solid, ground and polished, carbon steel, SAE 1045 material, machined to close tolerances, keyed to the fan wheel. Fan shaft shall be coated with a rust inhibitor after machining. Hollow shafts are not acceptable. Shafts must be fully protected by shaft sleeves constructed of FRP. A neoprene shaft seal shall be provided.

.10 Fan bearings shall be in self-aligning pillow block, grease lubricated, extra heavy duty antifriction ball or spherical roller type, selected for minimum 100,000 hours of ABMA L-10 bearing life at design operating conditions. Bearings shall be designed and individually tested specifically for use in air handling applications. Extended stainless steel lubrication line shall be provided to permit lubrication for both bearings to be performed from the access door.

.11 Fan size shall be selected to provide the required design volume at a fan static pressure that is indicative of 60% activated media.

.12 Fan shall be attached to the vessel by a heavy neoprene impregnated glass fabric, with double locking fabric to metal connection to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A.

.13 Motors shall be Totally Enclosed NEMA design B with class B insulation rated for emergency heavy-duty, with heavy-duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of heavy-gauge steel. Motors and drives shall be mounted on vibration isolators, out of the airstream where no contact between rotating components and the base shall occur. Fresh air for motor cooling shall be drawn into the motor compartment through a ten-square-inch tube free of discharge contaminants. Motors and drives shall be readily accessible for maintenance.

.14 The fan housing shall include a 6 mm drain hole in the bottom to allow drainage.

.15 All exposed rotating parts shall be fully enclosed by removable belt and shaft guards to OSHA standards. Guards shall facilitate measuring vibration on bearings.

.16 Belt guard shall be sized to allow either sheave to be increased by two sizes.

2.8 CHLORINE ABSORPTION MEDIA SECTION

.1 The toxic chemical scrubber shall be supplied with chlorine absorption media capable of absorbing 1 ton of dry chlorine gas. The media shall be capable of neutralizing chlorine under the following conditions:

.1 Removal Capacity of 15% by weight

.2 Temperature up 86C

.3 Moisture content up to 90% Relative humidity

.4 Minimum of 99.5% initial removal efficiency

.5 Air speed up to 2.54m/s (500 fpm)

.2 The chlorine absorption media must be non-hazardous both before and after chlorine absorption. The media must be non reactive to the outdoor site conditions listed in Section 02 22 10.01. The reaction heat from absorption must below the maximum temperature the toxic chemical scrubber can operate within.

2.9 ADDITIONAL OPTIONS

.1 The toxic chemical scrubber will be outfitted with the following options:

.1 125mm minimum diameter FRP exhaust stack, with bird screen and rain shield.

.2 Chlorine sensor within the duct mount kit on the exhaust stack.

.3 Differential pressure switch

.4 Dwyer magnehelic (or equivalent) differential pressure gauge to measure through entire media section.

2.10 ELECTRICAL AND CONTROLS

.1 Electrical components shall generally comply with intent of the Electric and Electronics Control Systems for HVAC Section 23 09 33. All electrical controls component and wiring shall be CSA-approved.

.2 Unless specified otherwise, toxic chemical scrubber shall be fed from 600V / 3PH / 60Hz power supply. Each unit shall be provided with a single electrical feed point. Where power is to be utilized at different voltages, the unit shall be provided built-in transformer(s).

.3 Units shall be supplied with NEMA 4 (NEMA 4X as noted for corrosive areas) control panel complete with hinged access door, unit mounted, or remote mounted as specified in the equipment schedules. The control panel shall include the following as minimum:

.1 Fan motor starters, overload and sub circuit fuses

.2 Disconnect switch

.3 Control circuit transformer

.4 System on green light

.5 General failure red light via an air proving switch

.6 Contacts for operation status and trouble alarms

.7 Contacts for interlock with fire/chlorine alarm system.

.8 Exhaust stack chlorine sensor reading

.4 The scrubber packaged unit shall have the following electrical characteristics included in the package system without any additional external equipment needed.

.1 Control output signal to feed a damper open signal at 120 VAC;

.2 Control input signal for PLC run command signal at 24 VDC.

.3 Scrubber Fail signal output suitable for 24 VDC.

.4 Scrubber Ready signal output suitable for 24 VDC

.5 Scrubber Auto Mode signal output suitable for 24 VDC.

.6 Scrubber Running signal output suitable for 24 VDC

.5 The Vendor shall provide instrumentation for all necessary monitoring where indicated in the equipment schedules, including but not necessarily limited to:

.1 The Vendor shall provide complete electrical and control schematic and wiring diagrams.

2.11 SURFACE PREPARATION AND FINISH

.1 Unless noted for component special painting and coating in this specification and the equipment schedules, unit painting and finish shall be per the Vendor's standard system but is subject to the City's approval.

.2 The Vendor may recommend their standard paint system with due regard for the duty and service as expressed in the equipment schedules. Finish color to be selected by the City.

PART 3 EXECUTION

3.1 IDENTIFICATION AND TAGGING

.1 All identification and tagging of equipment and instrumentation shall conform to the City's standards specified in this purchase inquiry.

3.2 FABRICATION

.1 Toxic chemical scrubber shall be skid mounted and pre-assembled to as maximum extent as possible. All instrumentation shall be pre-wired to junction boxes. All instrumentation sensing lines shall be pre-wired and identified for the mounting of field devices.

3.3 CLEANING

.1 Work to be done in accordance with Chlorine Institute recommendations and requirements.

.2 Carefully clean all portions of chlorine systems before use so that chlorine will not react violently with any cutting oil, grease and other foreign materials. Clean by pulling through each length of pipe a lint-free cloth saturated with trichloroethylene or other

suitable chlorinated solvent. Do not contact any plastic pipe or equipment with solvent. Hydrocarbons or alcohols are NOT ACCEPTABLE because residual solvent may react with chlorine. Dismantle and clean new valves and other equipment before use. If valve packings are oily or dirty, repack valves with manufacturer's recommended packing or PTFE. Test valves with clean, dry 21 MPa (300 psi) air for seat tightness as specified hereinbefore.

.3 Chlorinated solvents can produce very serious physiological effects unless used in strictest compliance with the solvent manufacturer's safety recommendations. Instruct workmen in the proper use, disposal and handling of these solvents.

3.4 MEDIA LOADING

.1 Contractor to provide temporary crane to load the dry media into the scrubber vessel. All lifts are to be performed by qualified crane operators.

3.5 TESTING AND INSPECTION

.1 Toxic chemical scrubbers shall be fully factory assembled and tested prior to shipment. Factory testing shall also include vibration amplitude measurement and testing at the factory.

.2 Provide media testing services as required throughout the Warranty period.

3.6 SHIPPING PREPERATIONS

.1 Refer to procurement documents for details.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E 84-11a, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 National Fire Protection Association (NFPA)

.1 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Equipment, capacity and piping connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect unit heaters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 CABINET UNIT HEATERS (FORCED FLOW UNITS)

.1 Supply and install cabinet heating units where indicated on the drawings and Equipment Schedule.

.2 Units shall be constructed of 16 gauge steel. Units shall come complete with 1" disposable filter and lockable control access door.

.3 Paint as per Section 09 91 23 – Painting.

.4 Coils shall be constructed of ½" OD seamless copper tube mechanically bonded to aluminium fins. The entire coil assembly is factory tested to 350 psig air pressure while the coil is submerged in water. It shall have a maximum working pressure of 300 psig. Coil connections are 1/2 " nominal (5/8" OD). Each coil shall be supplied with a manual air vent.

.5 All fan wheels shall be forward curve, centrifugal, and double-width galvanized steel. All fan housing shall be constructed of galvanized steel including mounting flange. Fans shall be quiet operating centrifugal blowers. Noisy units shall be replaced at suppliers expenses.

.6 Motors shall be permanent split capacitor, totally enclosed, tap wound for 3-speed, with integral thermal overload protection for 120V/60Hz/1Ph. All motors feature a standard shaft size of ½" diameter. Prior to shipping, all motors shall be assembled, factory tested and installed in the unit.

.7 Room thermostat: as per Section 23 09 33 -Electric and Electronic Control System for HVAC.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Make power and control connections.

.3 Include double swing pipe joints as indicated.

.4 Check final location with Contract Administrator if different from that indicated prior to installation.

.1 Should deviations beyond allowable clearances arise, request and follow Contract Administrator 's directive.

.5 Hot water units: for each unit, install ball valve on inlet and calibrated balancing valve on outlet of each unit. Install drain valve at low point.

.1 Install manual air vent at high point.

.6 Clean finned tubes and comb straight.

.7 Provide supplementary suspension steel as required.

.8 Install thermostats in locations indicated.

.9 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.3 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by unit heaters installation.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section covers items common to sections of Division 26 Electrical. This section supplements requirements of Division 1 General Requirements.

1.2 CODES AND STANDARDS

.1 Complete installation in accordance with CSA C22.1-2018 except where specified otherwise.

.2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

1.3 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for the completion and testing of the Work, and to render the system ready for operation.

.2 All materials, equipment, labor, work denoted on the drawing set is to be considered as new work, to be provided by the Contractor unless specifically noted otherwise. Some of the electrical and automation drawings show existing systems (with modifications to these systems). These drawings specifically indicated that there are existing systems shown. Where drawings do not specifically indicate that existing systems are depicted, the Contractor shall assume that the materials, equipment, labor, work indicated will form part of his scope, and the Contractor shall include all costs (including materials, labor, etc) to perform the Work.

.3 Prior to installing power and control cabling for process equipment, the Contractor shall review the equipment shop drawings, and to ensure that cabling requirements are understood. There may be variations in wiring requirements with process and HVAC equipment, that may require alternate wiring requirements from that shown on the drawings. Include such wiring and connections in tender at no additional costs.

.4 The intent of the Drawings and Specifications is to indicate labor, products, and services necessary for a complete, installed, tested, commissioned and functional installation.

.5 The electrical drawings in some cases indicate the size of cables, breakers, conduits, etc. These sizes are based on the supply of specific sizes of equipment. For cases where the Contractor supplies equipment that varies from these assumptions it is the responsibility of the Contractor to provide the correct size of breaker, cable, etc to suit the installation, at no additional cost to the Contract.

.6 The drawings in some cases, may indicate approximate route to be followed by conduits and cables and general location of electrical equipment. They do not show all structural, architectural and mechanical details. In some cases, conduit or wiring is only shown diagrammatically on the Drawings. The details on exact cable or conduit routing, and exact equipment installation location is to be determined on site and coordinated with all other trades.

.7 Where circuit numbers are shown adjacent to equipment, the electrical contractor shall provide all wiring, conduit, supports, and any other requirements to provide power to that piece of equipment from the circuit indicated. Where circuit numbers are not shown refer to the single line drawings for connections details. Provide all wiring, conduit, supports, and any other requirements to provide power to that piece of equipment.

.8 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.

.9 Various package unit types of equipment are included in the Work. It is the responsibility of the Contractor to familiarize himself with the requirements of the equipment vendor, and to include all materials and labor for a complete and working installation. In some cases this means that motors, valves, actuators, etc need to be wired and connected in the field. The Contractor shall include all costs to perform such services as part of his tender submittal. Coordination between the equipment vendor and the Contractor shall be performed prior to tender bid closing date, and all costs shall be included in the tender. Request for extras due to lack of coordination between the Contractor and the equipment vendors will not be accepted.

.10 These Specifications along with the Drawings and Specifications of all other divisions shall be considered as an integral part of the drawing package. Any item or subject omitted from the Specifications or the Drawings but which is mentioned or reasonably specified in the Drawings or Specifications of other divisions, shall be considered as properly and sufficiently specified and shall be provided.

.11 To provide sufficient detail and maximum degree of clarity on the Drawings, symbols used for various electrical devices, particularly wall mounted devices, take up more space on the Drawings than devices physically do. Locate devices with primary regard for convenience of operation, accessibility and space utilization, rather than locating devices to comply with the exact scaled locations of the electrical symbols.

.12 Provide all items and Work that are not shown or specified but which are reasonably necessary to complete the Work.

.13 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting a Bid, in accordance with B4.

.14 Where systems are shown as being removed or demolished, this means all associated systems back to the source power supply. For example – removal of light fixtures means complete removal of all wiring, conduit and controls back to source power supply. Re-wire and reconnect any systems to remain that are adversely affected by the demolition work. Site trace and site confirm wiring and circuits prior to removals.

.15 All new systems shall have new wiring and new conduit. Do not re-use existing conduit unless specifically indicated as acceptable. Provide new wiring and new conduit systems for all new devices.

.16 All equipment shall be installed and oriented in a manner such that maintenance can be performed on the equipment. Do not block components that are meant to be replaced or maintained.

1.4 CARE, OPERATION, AND START-UP

.1 Instruct City maintenance and operating personnel in the operation, care, and maintenance of systems, system equipment, and components.

.2 Provide these services for such period, and for as many visits as necessary, to put equipment in operation and to ensure that the City operating personnel are conversant with all aspects of its care and operation.

1.5 PERMITS, FEES, AND INSPECTION

.1 Submit to the Electrical Inspection Department and Supply Authority the necessary number of Drawings and Specifications required for examination and approval prior to commencement of the Work.

.2 Pay associated fees.

.3 Notify the Contract Administrator of changes required by Electrical Inspection Department and Supply Authority prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from the Electrical Inspection Department and Supply Authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment, which is not CSA certified, obtain special approval from the Electrical Inspection Department and Supply Authority.

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

1.7 ELECTRICAL EQUIPMENT MODIFICATION

.1 Where electrical equipment is field modified, arrange for special inspection from the Electrical Inspection Department and Supply Authority and pay all associated fees.

1.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

1.9 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic lamicoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

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
Size 8	35 x 100 mm	3 lines	5 mm high letters

.3 Wording on nameplates to be approved by the Contract Administrator prior to manufacture.

.4 Allow for average of 25 letters per nameplate.

.5 Identification to be English.

1.10 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.11 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.12 WARNING SIGNS

.1 As specified and to meet requirements of the Electrical Inspection Department and Supply Authority and the Contract Administrator.

.2 Lamicoid 3 mm thick plastic engraving sheet, red face, white core, mechanically attached with self tapping screws, 20mm text.

1.13 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

1.14 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 For mounting heights, equipment to be mounted in accordance with Code requirements.

.3 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.4 Install electrical equipment at following heights unless indicated otherwise.

.1 Panelboards: 1800mm to top
.2 Light switches: 1420mm to top
.3 Wall receptacles: 900mm to top
.4 Control panels: 1800mm to top
.5 Emergency lights: 2400mm (minimum)
.6 Emergency stop switches: 1500mm to top
.7 Motor disconnect switches: 1800mm to top
.8 Fire Alarm Devices: In accordance with Code Requirements

1.15 CONDUIT AND CABLE INSTALLATION

.1 Sleeves through concrete: schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 100 mm above finished floor level.

.3 Fire stop opening with ULC approved assembly for the installation conditions.

1.16 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentice program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The Work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba.

1.17 TESTING

.1 All test instruments utilized are to have been calibrated within one year of the date utilized.

.2 Perform tests on all electrical and instrumentation in accordance with the latest of NETA Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.18 SUBMITTALS

.1 Prior to delivery of any products to Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings and submittals in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.

.3 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

.4 CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

1.2 SUBMITTALS

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

Part 2 Products

2.1 GENERAL

.1 Wire: to CAN/CSA-C22.2 No. 38

.2 Conductors:

.1 Size as indicated. Minimum size for power wires: 12 AWG unless noted otherwise on the Drawings.

.2 Stranded for 10 AWG and larger and as specifically indicated herein.

.3 All conductors to be copper.

.3 Voltage rating:

.1 Power circuits 480 V and less: 600 V

.2 Power circuits > 480 V: 1000 V

.3 Insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.4 Power supply conductor colour coding shall be in accordance with the Canadian Electrical Code. Wires sized 2 AWG and smaller to be factory-coded, taping will not be accepted.

.5 Control / Automation Wire Color Coding

.1 Utilize the following wire colours for the types of voltage/signals indicated:

.1	120VAC Line:	Black
.2	120VAC Control:	Red
.3	120VAC Neutral:	White
.4	24VDC Supply:	Blue
.5	24VDC Control:	Blue
.6	24VDC Common:	Brown

.7	4-20mA Signal:	White (+), Black (-)
.8	Protective Earth:	Green
.9	Signal Ground:	Green/Yellow

.6 Acceptable cable manufacturer: Belden, Nexans, General Cable, Southwire, or approved equal in accordance with B7.

2.2 TECK 90 CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: polyvinyl chloride material.

.7 Fastenings:

.1 One hole malleable iron / steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 8 mm dia. to support suspended channels.

.4 Stainless steel straps, hardware, channels, supports for Nema 4, Nema 4x, CSA enclosure type 4, CSA enclosure type 4X areas, all wet areas.

.8 Connectors:

.1 Watertight, approved for TECK cable:

.1 an elastomeric bevelled bushing.

.2 a funnel entry, splined gland nut.

.3 a taper threaded hub.

.4 a hexagonal body and gland nut

.9 Acceptable cable manufacturer: Nexans, General Cable, Southwire, or approved equal in accordance with B7.

2.3 ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 Conductors: copper, stranded, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene(XLPE) rated type RW90.

.1 Voltage: 600V insulation

.4 Shielding as indicated on the drawings:

.1 ISOS – Individually shielded pairs with overall shield

.2 OS – Overall shield

.3 A higher level of shielded cable may be substituted for unshielded or overall shielded cable, unless otherwise specified, provided that all appropriate shield grounding, as required by the Contract Administrator, is performed. All subsequent related changes, such as required conduit size, fittings, etc, are the responsibility of the Contractor.

.5 Armour Type: Aluminum Interlocked

.6 RoHS compliant.

.7 Fastenings:

.1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole aluminum straps for cables larger than 50 mm.

.2 Channel type supports for two (2) or more cables at 1000 mm centers.

.3 Threaded rods: 8 mm dia. to support suspended channels.

.4 Stainless steel straps, hardware, channels, supports for Nema 4, Nema 4x, CSA enclosure type 4, CSA enclosure type 4X areas, all wet areas.

.8 Connectors:

.1 Watertight, approved for TECK cable:

.1 an elastomeric bevelled bushing.

.2 a funnel entry, splined gland nut.

.3 a taper threaded hub.

.4 a hexagonal body and gland nut.

.9 Acceptable cable manufacturer: Nexans, General Cable, Southwire, or approved equal in accordance with B7.

2.4 ETHERNET CABLE - SHIELDED & NON-ARMORED

.1 Requirements:

.1	Cable:	Industrial Grade Cat 6, 600V, Shielded
.2	Shield Design:	100 % coverage Foil Shielded
.3	Conductors:	4 pair, Bonded pair, 23 AWG, copper, solid.
.4	Insulation:	Polypropylene
.5	Operating temperature:	-40°C to 75°C
.6	Installation temperature:	-25°C to 75°C
.7	Flame test:	CSA FT4

.8 cUL, CMR, RoHS compliant.

.9 Traction stress maximum: 177.928 N

.10 Minimum bending radius: 101.600 mm

.11 Manufacturer:

.1 Belden 7953A

.2 Or approved equal in accordance with B7.

2.5 FIRE ALARM WIRING

.1 Refer to Section 28 31 02 – Multiplex Fire Alarm Systems for details.

.2 Low energy, 300 V, FAS 105 shielded cable: minimum #16AWG (or larger), with PVC insulation.

.3 Overall aluminum /polyester foil shield, with tinned copper drain wire.

.4 All fire alarm cables shall be installed in a separate, dedicated conduit system.

.5 Acceptable cable manufacturer: Belden, Nexans, General Cable, Southwire, or approved equal in accordance with B7.

2.6 INSULATED GROUND CONDUCTORS

.1 Insulated copper ground conductors:

.1 Size: as indicated on the Drawings, but in no case smaller than CEC required sizes.

.2 Type: soft drawn, stranded, flexible, high conductivity

.3 Shall meet the requirements of ASTM B8.

.4 Insulation: chemically cross-linked thermosetting polyethylene (XLPE) material, rated RW90

.5 Flame Test Rating:

.1 CSA FT4 (if exposed)

.2 CSA FT1 (if entirely within conduit)

.6 Insulation voltage rating: 600V

.7 Colour: green or green with yellow stripes as indicated on the Drawings.

.2 Acceptable cable manufacturer: Belden, Nexans, General Cable, Southwire, or approved equal in accordance with B7.

2.7 BARE GROUND CONDUCTORS

.1 Bare copper ground conductors:

.1 Size: as indicated on the Drawings, but in no case smaller than CEC required sizes.

.2 Type: soft drawn, stranded, flexible, high conductivity.

.3 Shall meet the requirements of ASTM B8.

.2 Acceptable cable manufacturer: Belden, Nexans, General Cable, Southwire, or approved equal in accordance with B7.

2.8 CABLE / WIRE TAGS

.1 Cable and conduit tags to be Brady B33-7515-7643 or approval equal in accordance with B7.

.2 Wire tags to be Brady polyolefin wire marking sleeves, suitable for the wire size

.3 All marking shall be typewritten in permanent ink.

.4 Affix tags using plastic tie-wraps

Part 3 Execution

3.1 GENERAL

.1 Provide cable size and type as indicated on the drawings. Contractor shall require approval from Contract Administrator to provide different cable type.

.2 Do not splice cables. A continuous length is required for all feeds.

.3 Install in accordance with the manufacturer's recommendations, observing requirements for minimum bending radius and pulling tensions.

.4 Install in conduit as per Section 26 05 34 - Conduits, Conduit Fastenings, and Fittings. Alternatively, for armored cabling, provide cable tray for cable installation.

.5 Exercise care in stripping insulation from wire. Do not nick conductors.

.6 Provide bonding conductors as required by code as a minimum, or larger if indicated in the Contract documents.

.7 Provide scanning, coring, and drilling for installation of all wires and cables through concrete or structural members. Ensure damage to structures or other systems does not occur.

3.2 INSTALLATION OF TECK CABLES

.1 Provide cable tray for all Teck 90 cable runs.

.2 Surface mount runs less than 2 meters in length for direct connections to motors / equipment provided that cabling does not interfere with access into space, or with maintenance of systems. Provide clamps spaced a maximum of 1 m apart.

.3 Perform an insulation-resistance test on each conductor, prior to termination, utilizing a megohmmeter with a voltage output of 1000 volts DC. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute. Investigate resistances less than 50 megaohms or deviations between parallel conductors. Conductors with insulation resistance values, at one minute, less than 25 megaohms or that deviate from other similar conductors by more than 50% will be rejected.

3.3 INSTALLATION OF CONTROL AND INSTRUMENTATION CABLES

.1 Provide cable tray or conduit for all control cables. All non-armored cables shall be installed in conduit. Armored control cables shall be installed in cable tray.

.2 Ground shields at one end only. Where possible, ground shields at the end where power is supplied to the cable. Utilize shield grounding bar in panels, where present, to ground overall shields. Individual pair shields to be grounded on appropriate terminals.

.3 Shield drain wires, at the ungrounded end, are to be taped back to the cable. Fully insulate the shield. Do not cut the shield drain wire off.

.4 ACIC cable may be installed in cable tray, provided that:

.1 The cable tray does not contain power cables unless specifically authorized by the Contract Administrator in writing.

.2 The ACIC cable voltage rating is equal or greater than the highest voltage contained in the cable tray.

.5 Provide separation of cables from sources of noise, including other cables.

.1 For analog signals, provide separation distances as follows:

.1	120 VAC, 8 AWG and smaller:	100 mm
.2	120 VAC, >8 AWG:	300 mm
.3	600 VAC power:	300 mm
.4	VFD or other high harmonic cable:	300 mm in metallic conduit/600 mm other raceway
.5	Medium Voltage:	450 mm

.2 For control signals < 50V, provide separation distances as follows:

.1	120 VAC, 8 AWG and smaller:	50 mm
.2	120 VAC, >8 AWG:	300 mm
.3	600 VAC power:	300 mm
.4	VFD or other high harmonic cable:	300 mm in metallic conduit/600 mm other raceway
.5	Medium Voltage:	450 mm

.3 For 120 VAC control signals, provide separation distances as follows:

.1	120 VAC, 8 AWG and smaller:	none
.2	120 VAC, >8 AWG:	metal barrier or 150 mm
.3	600 VAC power:	metal barrier or 150 mm
.4	VFD or other high harmonic cable:	150 mm in metallic conduit/300 mm other raceway
.5	Medium Voltage:	450 mm

.4 Advise the Contract Administrator if these separations cannot be achieved.

3.4 INSTALLATION OF ETHERNET COPPER CABLES

.1 Where surface mounted, provide clamps spaced a maximum of 1 m apart, unless otherwise indicated.

.2 Provide separation of Ethernet cables from sources of noise, including other cables.

.1 Provide separation distances as follows:

.1	Instrumentation/Control < 50:	50 mm
.2	120 VAC, 8 AWG and smaller:	100 mm
.3	120 VAC, >8 AWG:	300 mm
.4	600 VAC power:	300 mm
.5	VFD or other high harmonic cable:	300 mm in metallic conduit/600 mm other raceway
.6	Medium Voltage:	450 mm

.2 Advise the Contract Administrator if these separations cannot be achieved.

.3 Ethernet cables shall be installed in conduit.

3.5 INSTALLATION OF FIRE ALARM CABLING:

.1 Install in conduit as per Section 26 05 34 - Conduits, Conduit Fastenings, and Fittings.

.2 Install conductors to be entirely independent of all other wiring. Do not enter raceway, boxes, or enclosures occupied by other wiring except where necessary to connect to power supply, communication circuit, or ancillary devices.

.3 Shields to be grounded at one end only (source end).

.4 For data communication link A (DCLA) fire alarm circuits, install primary wiring circuit independent and separate from the alternate wiring circuit wiring - in separate conduit system having a minimum separation of:

.1 300mm when installed vertically

.2 1200mm when installed horizontally

.5 In accordance with CAN/ULC-S524, for data communication link A (DCLA) fire alarm circuits, the primary wiring circuit and alternate wiring circuit may share the same conduit under specific strict installation scenarios, as follows:

.1 For a distance of less than 3000mm where the primary and return conductors enter or exit field devices, control unit or transponder enclosures.

.2 For single conduit drops to individual field devices.

.3 For single conduit drops to multiple field devices installed in a single room not exceeding 100m².

3.6 TERMINATIONS AND SPLICES

.1 Wire nuts are permitted only in the following circuits:

.1 Lighting circuits.

.2 Power receptacle and motor circuits.

.2 Terminate wiring on terminal blocks located inside junction boxes for other circuits:

.1 Fire alarm,

.2 Controls and instrumentation,

.3 Communications,

.3 Exercise care in stripping insulation from wire. Do not nick conductors.

.4 Strictly follow the manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

.5 Where screw-type terminals are provided on equipment and instrumentation, terminate field wiring with insulated fork tongue terminals.

.1 Manufacturer: Thomas and Betts, Sta-Kon, or approved equal in accordance with B7.

3.7 INSTALLATION IN CONDUIT

.1 Utilize cable grips, appropriately selected to accommodate the type and geometry of the cable.

.2 Utilize cable pulling lubricant, compatible with the cable and conduit.

3.8 CABLE INDENTIFICATION

.1 Provide cable tags at both ends for all cables.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

1.2 SUBMITTALS

.1 Provide shop drawing and O & M submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings and product data:

.1 Provide manufacturer's printed product literature and datasheets.

.2 Indicate connection details.

Part 2 Products

2.1 EQUIPMENT

.1 Insulated grounding conductors: green, type RW90.

.2 Grounding rod: copper clad steel, 21mm (3/4") diameter, length as indicated on the drawings – but in no case less than 10 feet long.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install connectors in accordance with manufacturer's instructions.

.2 Protect exposed grounding conductors from mechanical injury.

.3 Use mechanical connectors for grounding connections to equipment provided with lugs.

.4 Use Burndy compression connectors, or approved equal in accordance with B7, for all grounding splices and terminations, unless otherwise indicated.

.5 Soldered joints not permitted.

3.2 EQUIPMENT GROUNDING AND BONDING

.1 Install grounding connections to transformers.

.2 Install bonding connections to all equipment in accordance with minimum code requirements. Exceed minimum requirements where sizes and materials deviate from the code.

.3 Include a separate green bonding wire in all power conduits including branch circuit wiring sized according to the largest power conductor in the conduit:

.1 8 AWG green ground wire for up to 4 AWG power conductors.

.2 6 AWG green ground wire for up to 2 AWG power conductors.

.3 Larger as required by the Canadian Electrical Code.

.4 Install grounding and bonding connections for system, which include, but are not limited to communications, sound, fire alarm, controls, instrumentation, and intercommunication systems.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Provide shop drawing and O & M submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings and product data:

.1 Provide manufacturer's printed product literature and datasheets.

.2 Indicate connection details.

Part 2 Products

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.1 Indoors, dry locations: Conduit support structures shall employ an aluminum strut framing system together with the manufacturer’s connecting components and fasteners for a complete system.

.2 Exterior and Category 2 locations: 316 stainless steel. The Chlorine Building at each stations is classified as Category 2.

.2 Accessories:

.1 Exterior and Category 2 locations: 316 stainless steel.

.2 Nuts, bolts, washers, machine screws, fittings, accessories: 316 Stainless steel.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials: hardened steel inserts, zinc plated for corrosion resistance.

.2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.

.3 Manufacturer: Hilti (Canada) Limited or approved equal in accordance with B7.

2.3 SPACERS

.1 PVC coated malleable metal spacers, CSA approved for the purpose.

.2 Aluminum or stainless steel (wet locations) channel may be utilized where conduits are grouped, however a non-metallic spacer must be provided between the metallic channel and concrete.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile, or plaster surfaces with galvanized anchors.

.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, or cable clamps designed as accessories to basic channel members.

.5 Maximum spacing between conduit supports:

.1	16mm conduit:	1.0 m
.2	21mm conduit:	1.5 m
.3	27mm conduit	1.5 m
.4	35mm conduit	2.0 m
.5	41mm conduit and larger	2.5 m

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole straps for conduits and cables larger than 50 mm.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 8 mm dia threaded rods and spring clips.

.2 Support two or more cables or conduits on channels supported by 8 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels for supports of the conduits.

.9 For surface mounting of conduit on a concrete surface, provide PVC coated conduit spacers. Do not mount conduit directly onto concrete surfaces.

.10 Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support conduit and cable runs.

.11 Do not install conduit directly onto concrete. Provide offset supports.

.12 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.

.13 Do not use wire lashing or perforated strap to support or secure cables.

.14 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.

.15 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with the manufacturer's installation recommendations.

.16 Bond all metallic components to ground, utilizing 2/0 AWG copper conductor for all systems that are part of a Station in accordance with the Canadian Electrical Code.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for splitters, junction, pull boxes, and cabinets.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.76, Splitters
1. CSA C22.2 No. 94.1, Enclosures for Electrical Equipment, Non-Environmental Considerations.
2. CSA C22.2 No. 94.2, Enclosures for Electrical Equipment, Environmental Considerations.
3. UL 508A, Standard for Industrial Control Equipment.

1.3 SUBMITTALS

.1 Provide shop drawing and O & M submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings and product data:

.1 Provide manufacturer's printed product literature and datasheets.

.2 Indicate all wiring and connection details.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Junction boxes and pull boxes installed in dry, non-hazardous, non-corrosive type of locations:

.1 Use CSA enclosure type 2 or greater for normal dry area.

.2 Use sealed, gasketted, CSA enclosure type 12 for sprinklered areas.

.3 To be constructed of sheet metal for normal dry areas.

.4 To be constructed of rigid PVC, FT4 materials for wet corrosive area (McPhillips, Maclean, Hurst Chlorine Building Chlorine Tonner Room and Equipment Room).

.5 For boxes 100 mm square and smaller, screw-on type, flat covers.

.6 For boxes larger than 100mm square, box covers are to have a continuous piano hinge and clamps for opening.

.2 Junction boxes and pull boxes for wet or wet and corrosive locations:

.1 CSA enclosure type 4X, gasketted.

.2 Constructed of rigid PCV, FT4 rated materials.

.3 Utilize 316 stainless steel bolts, washers and mounting hardware.

2.2 CABINETS

.1 Where indicated on the drawings, provide cabinets in accordance with the bill of materials shown on the drawings.

.2 Cabinets installed in dry, non-hazardous, non-corrosive process locations:

.1 To CSA C22.2 No. 94.1 94.2 and UL 508A
.2 CSA enclosure type 12 or greater, gasketted.
.3 To be constructed of painted, mild steel.
.4 Back-plate with offsets for installation of devices.
.5 Continuous piano hinge, door with quarter turn latch and handle.

.3 Cabinets installed in exterior or wet, or corrosive locations (including in the McPhillips Chlorine Building Tonner Room and Equipment Room):

.1 To CSA C22.2 No. 94.1, 94.2 and UL 508A
.2 Refer to the drawings for acceptable make / model / construction materials. In the absence of this information, comply with:
.1 CSA enclosure type 4X, gasketted.
.2 To be constructed of 316 stainless steel.
.3 Back-plate with offsets for installation of devices.
.4 Continuous piano hinge, door with quarter turn latch and handle.

Part 3 Execution

3.1 JUNCTION, PULL BOXES, AND CABINETS INSTALLATION

.1 Utilize CSA enclosure type 4X for:

.1 All exterior mounted equipment.
.2 All equipment located in the Chlorine Building Tonner Rooms and Equipment Rooms.
.3 All wet locations.

.2 Install pull boxes in inconspicuous but accessible locations.

.3 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.4 Install junction and pull boxes so as not to exceed 30 m of conduit run between devices. Add additional boxes so to meet all code requirements.

.5 Cabinets to be either floor mounted or cantruss back-mounted. For cantruss back-mounted cabinets, provide cantruss support structures behind cabinet for mounting.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 3 identification labels indicating system voltage and phase.

.3 Install a permanent label or lamacoid on the cover of all junction boxes indicating the circuit(s) contained within.

.1 Example: C711-13 (Panelboard PNL-C711, circuit 13)

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures

.2 Section 26 05 01 Common Work Results – Electrical

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 Size outlet boxes as required to accommodate wiring devices.

.3 102 mm square or larger outlet boxes as required.

.4 Gang boxes where wiring devices are grouped.

.5 Provide blank stainless steel cover plates for boxes without wiring devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 Knock-out covers for sealing penetration holes.

2.2 BOXES FOR ELECTRICAL METALLIC TUBING (EMT) CONDUIT

.1 General Requirements:

1. Stainless steel cover plates
2. To CSA 22.2 No. 18.

.2 Junction and Pull Boxes:

1. 102 mm (4”) square, galvanized steel boxes with knockouts.
2. Raised ground screw bump

.3 Device/Utility box, Surface Ceiling Mount:

.1 Application: for surface ceiling mounting of devices

.2 Material: drawn steel, galvanized

.3 Raised ground screw bump

.4 102 mm (4”) round or octagonal boxes with knockouts

.5 Depth: as required

.4 Device/Utility boxes, Surface Wall Mount:

1. Application: for surface wall mounting of light switches and receptacles.
2. Material: drawn steel, galvanized
3. Raised ground screw bump
4. Depth: 47.625 mm (1 7/8") minimum
5. Manufacturer / Model:
   a. Thomas & Betts Iberville BC1110
   b. Or approved equal in accordance with B7.

2.3 BOXES FOR PVC CONDUIT

.1 General Requirements:

.1 Mounting lugs as required.

.2 To CSA C22.2 No. 18.

.2 Junction and Pull Boxes:

.1 102 mm (4") square, PVC boxes with non-threaded hubs

.3 Device/Utility Boxes, Surface Ceiling Mount:

.1 Application: for surface ceiling mounting of devices

.2 102 mm (4") round or octagonal, PVC boxes with non-threaded hubs

.4 Device/Utility Boxes, Surface Wall Mount:

.1 Application: for surface mounting of light switches and receptacles

.2 Material: PVC

.3 Grounding strap.

.4 Light switches to be supplied with PVC toggle cover

.5 Manufacturer / Model:

.1 Thomas & Betts Carlon FS or FD series

.2 Or approved equal in accordance with B7.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 General

.1 Provide boxes sized as required by the Canadian Electrical Code.

.2 Support boxes independently of connecting conduits.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.4 Install fittings in accordance with the manufacturer's recommendations.

.5 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.6 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.7 Install all outlets surface mounted as required for the installation.

.8 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.

.9 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.

.10 Vacuum clean interior of outlet boxes before installation of wiring devices.

.11 Extension rings shall not be utilized to accommodate conductor fill requirements.

.12 Confirm the direction of door swings on site, to confirm that outlet boxes for light switches are located on the latch side of the door.

.13 Provide lamacoid for all device boxes indicating the circuit(s) contained within.

.14 Provide permanent lamacoid label for all device boxes indicating the circuit(s) contained within.

.1 Example: C711-13 (Panelboard PNL-C711, circuit 13)

.2 Non-hazardous, dry office areas:

.1 Provide commercial series, sheet metal outlet boxes and fittings.

.2 Outlet boxes that penetrate opposite sides of a wall shall be offset to maintain the integrity of the fire separation. Boxes shall not be installed back-to-back.

.3 Exterior or exterior, wet, or corrosive areas (including the Chlorine Buildings at McPhillips, Maclean, and Hurst Pumping Stations):

.1 Provide PVC outlet boxes, conduit boxes, and fittings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CSA C22.2 No. 45.1, Electrical Rigid Metal Conduit - Steel.
- .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 211.2, Rigid PVC (Un-plasticized) Conduit.
- .5 CAN/CSA C22.2 No. 227.3, Flexible Non-metallic Tubing.

1.2 SUBMITTALS

.1 Provide shop drawing and O & M submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings and product data:

- .1 Provide manufacturer's printed product literature and datasheets.

Part 2 Products

2.1 GENERAL

.1 Material Requirements:

- .1 Outdoor and Buried: PVC
- .2 Main Floor, Normal Area - Instrumentation / Process Related: Electrical Metallic Tubing (EMT)
- .3 Main Floor, Normal Area – Lighting, Power, Receptacles, Fire Alarm: EMT
- .4 Basement Floor, Normal Area – Lighting, Power, Receptacles, Fire Alarm: EMT
- .5 Chlorine Building Tank Room and Equipment Room: Rigid PVC, FT4 rated

2.2 ELETRICAL METALLIC TUBING

.1 Meet the requirements of C22.2 No. 211.2.

.2 Materials: steel, electroplated outside finish, aluminum painted inside walls.

.3 Minimum conduit size: 21 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

2.3 RIGID METAL CONDUIT

.1 Threaded metal conduit, meets CSA C22.2 No. 45.1, rigid metal conduit - steel

.2 Minimum conduit size: 21 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

2.4 RIGID PVC CONDUIT

.1 Meets CSA C22.2 No. 211.2.

.2 Minimum conduit size: 21 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

2.5 FLEXIBLE METAL CONDUIT

.1 To CSA C22.2 No. 56, liquid-tight flexible metal.

.2 Minimum conduit size: 21 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

2.6 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Strap material to match conduit material.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits or as shown in the Drawings.

.5 316 stainless steel threaded rods, 8 mm dia., to support suspended channels.

2.7 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 All fittings to be liquid and dust tight.

.3 Enclosure Connections

.1 Connections in dry locations (bottom or side)

.1 Locknuts inside and outside enclosures.

.2 Insulated bushings Thomas & Betts Series 222 or approved equal in accordance with B7.

.2 Connections in wet locations and tops of enclosures in dry locations

.1 Liquid-tight threaded hubs.

.2 Insulated bushings Thomas & Betts Series 222 or approved equal in accordance with B7.

.3 Utilize insulated grounding bushings at all non-metallic enclosure entries for metallic conduit, or as required for bonding in accordance with Canadian Electrical Code and good practice.

.4 Elbows:

.1 Utilize factory elbows for 27mm and larger conduits.

.5 Threaded Hubs for Metal Conduit

.1 Liquid and dust tight with insulated throat.

.2 Approved products

.1 Thomas & Betts "Bullet Hub" 370AL Series.

.2 Or approved equal in accordance with B7.

.6 Fittings for Metal Conduit

.1 Cast metal.

.2 Gasketted covers.

.3 Approved products

.1 Crouse-Hinds Canada Ltd. "Condulet" series.

.2 Or approved equal in accordance with B7.

.7 Sealing Compound. As recommended by manufacturer.

2.8 CONDUIT SPACERS

.1 PVC coated malleable iron spacers, CSA approved for the purpose.

.2 Aluminum channel may be utilized where conduits are grouped, however a non-metallic spacer must be provided between the aluminum channel and concrete.

2.9 FISH CORD

.1 Polypropylene

2.10 CONDUIT TAGS

.1 Cable and conduit tags to be Brady B33-7515-7643 or approval equal in accordance with B7.

.2 All marking shall be typewritten in permanent ink.

.3 Affix tags using plastic tie-wraps

Part 3 Execution

3.1 ROUTING

.1 Locate conduits containing communication and low voltage conductors away from conduits containing power wiring.

.2 Route conduits on existing or new pipe rack or suspended channels where possible.

.3 Avoid routes that would interfere with any potential maintenance activities.

.4 Where not specifically shown in detail on the Drawings, review proposed conduit routing with the Contract Administrator prior to installation. Comply with all routing changes requested by the Contract Administrator.

3.2 INSTALLATION - GENERAL

.1 Provide conduit tags, for all conduits, at both ends, plus at every pull box and junction box.

.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.3 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.4 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.5 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.

.6 Ensure electrical continuity in all metallic conduit systems.

.7 All conduits shown exposed in finished areas is to be free of unnecessary labels and trademarks.

.8 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant. Seal all conduits entering or leaving exterior areas with approved seals.

.9 Where conduits pass through walls, group and install through openings. After all conduits shown on the Drawings are installed, close wall openings with material compatible with the wall construction, and provide fire stopping.

.10 For metallic conduits, install within a galvanized steel, schedule 40 sleeve for holes / penetrations through concrete walls and slabs.

.11 Install fish cord in empty conduits.

.12 Dry conduits out before installing wire.

.13 Install ground bonding wire in all conduits. Size bond / ground wire as per Canadian Electrical Code.

.14 Underground Conduits

.1 Slope conduits to provide drainage.

.15 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended or surface channels.

.3 Provide a minimum space of 12 mm between conduits.

.4 Do not pass conduits through structural members except as indicated.

.5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.6 Install spacers as required to provide a space between the conduits and the supporting surface, with a minimum space as follows:

.1 Above grade spaces not classified as Canadian Electrical Code Category 1 or 2:

.1 Drywall / Wood surfaces: no space required

.2 Masonry / concrete surfaces: 6 mm

.2 Below grade spaces: 12 mm

.16 Colour Coding

.1 Apply plastic tape or paint colour coded bands to conduits at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.

.2 Bands: 38 mm wide prime colour and 19 mm wide auxiliary colours.

.3 Band colours as per the following table:

System	Prime Band	Aux. Band
Medium Voltage (>750 V)	Orange	
347/600 V	Yellow	
120/208/240 V Power	Black	
UPS 120/208/240 V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring (<50 V)	Blue	Orange
Intrinsically Safe	Blue	White

3.3 PVC CONDUIT

.1 Concrete Penetrations:

.1 Seal and firestop penetration around conduit with ULC approved assembly for the installation conditions.

.2 Maximum spacing between supports for rigid PVC conduit:

.1	27mm conduit	0.75 m
.2	35mm conduit	0.75 m
.3	41mm conduit	1.2 m
.4	53mm conduit	1.5 m
.5	63mm conduit	1.5 m
.6	78mm conduit	1.5 m
.7	91mm conduit and larger	2.0 m

3.4 METAL CONDUIT

.1 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.2 Mechanically bend conduits over 19 mm in diameter.

.3 Concrete Penetrations:

.1 Sleeves for Conduit

.1 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 Seal and firestop penetration around conduit with ULC approved assembly for the installation conditions.

.3 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 50 mm above finished floor level or housekeeping pad level.

.4 Maximum spacing between supports for rigid metallic conduit:

.1	16mm conduit:	1.0 m
.2	21mm conduit:	1.5 m
.3	27mm conduit	1.5 m
.4	35mm conduit	2.0 m
.5	41mm conduit and larger	2.5 m

3.5 LIQUID-TIGHT FLEXIBLE CONDUIT

.1 Use as raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water.

.2 At all motors, provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus four times the conduit diameter.

.3 Provide a separate ground wire within the flexible conduit, bonded to motor frames and system ground.

3.6 INSTALLATIONS IN CATEGORY 1 LOCATIONS

.1 Arrange to provide drainage at frequent intervals to suitable locations.

.2 Equip with approved fittings to permit the moisture to drain out of the system.

.3 Install the conduit with a minimum of 12 mm space from the supporting surface.

.4 Install every joint to be water-tight.

.5 Where conduit leaves a warm room and enters a cooler atmosphere, seal the conduit and arrange the conduit in a manner to avoid condensation accumulation at the seal.

3.7 INSTALLATIONS IN CATEGORY 2 LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.8 INSTALLATIONS IN CATEGORY 2 WET LOCATIONS

.1 Comply with all requirements of Category 1 locations.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 InterNational Electrical Testing Association (NETA) Acceptance Testing Specifications, 2017 (ATS-2017)

1.2 TESTING REPORT

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

.2 A draft individual inspection and test report shall be completed for each piece of equipment and sent to the Contract Administrator for review a maximum of one month after the completion of the inspections at the Site.

.3 Upon acceptance of all the individual inspection and test reports, prepare and submit to the Contract Administrator for review a draft overall inspection and test report that details all investigations and tests.

.4 The report shall include the following:

- .1 Summary of project.
- .2 Testing equipment used.
  - .1 Detail the type, manufacturer, model, and last calibration date of all testing equipment.
- .3 Description of equipment tested.
- .4 Description of all tests.
- .5 Typed inspection forms including:
  - .1 Identification of the testing organization.
  - .2 Equipment identification.
  - .3 Humidity, temperature, and other conditions that may affect the results of the tests/calibrations.
  - .4 Date of inspections, tests, maintenance, and/or calibrations.
  - .5 Identification of the testing technician.
  - .6 Indication of inspections, tests, maintenance, and/or calibrations performed and recorded, along with charts and graphs as applicable. All measurements and readings taken shall be noted for inclusion in the report. Where repairs are made, measurements and readings before and after the repair shall be included.
  - .7 Indication of expected results, when calibrations are to be performed.
  - .8 Indication of “as-found” and “as-left” results, as applicable.
- .6 Itemized list of all repaired deficiencies which shall include:
  - .1 Detailed description of the deficiency.
  - .2 The cost associated with the deficiency repair.
- .7 Itemized list of all un-repaired deficiencies encountered which shall include:
  - .1 Detailed description of the deficiency.

.5 The overall inspection and test report shall be neat and organized. Any omissions, inconsistencies, or incomplete work identified by the Contract Administrator shall be corrected and incorporated into the overall inspection and test report in the appropriate section and completely resubmitted.

.6 The Contractor shall furnish three paper copies and two electronic copies of the final overall inspection and test report.

.1 The electronic copies of the report, including the test forms, shall be provided in both PDF format and in native format (i.e Microsoft Word).

.7 The final overall inspection and test report shall be submitted a maximum of two weeks after the Contractor receives the mark-up of the draft overall inspection and test report from the Contract Administrator.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 SCOPE OF TESTING

.1 Added equipment in existing Motor Control Centres (MCCs), including but not limited to:

.1 Surge Protector
.2 CTs (if present)
.3 PTs (if present)
.4 Motor Starters
.5 Circuit Breakers
.6 Overloads
.7 Controls and communication equipment

.2 120V VFD

.3 120V Motor Starter.

.4 Fire alarm system

.5 Emergency lighting

.6 All power cables greater than #6 AWG.

3.2 INPECTION, TESTING, AND MAINTENANCE PROCEDURES

.1 General

.1 All tests shall be performed based on NETA standard ATS-2017. Where manufacturer's specifications, tolerances, and/or published data are not available, refer to the appropriate tables in ATS-2017.

.2 Torque all accessible bolted electrical connections. Additional requirements apply as specified.

.3 Utilize the existing Drawings for reference while performing the specified electrical inspection work. Where the existing installation deviates from that shown on the Drawings, mark-up the Drawings with red pen as required to reflect the installation. Include the marked-up Drawings in the report.

.4 The scope of required Drawing checks is limited to the equipment and components that are part of the electrical inspection work.

.5 Any repairs made that affect the accuracy of the Drawings shall be marked up on the Drawings.

.6 Drafting of Drawings is not required.

.7 All inspection values, readings, corrections, and assessments shall be clearly recorded for inclusion within the individual inspection and test report.

.8 Where corrections or repairs are made, record both as found/as left test readings on the inspection form. If space is not provided on the inspection form, record the readings in the Note fields or on a separate sheet.

.2 Inspection Forms

.1 The inspection forms to be completed by the Contractor are provided for reference in PDF format.

.2 Microsoft Word form templates will be provided prior to the Work being initiated.

.3 Make appropriate print-outs of the inspection forms and utilize for entry of data and test results on Site.

.4 Utilizing the Microsoft Word form templates, enter the data recorded manually into the forms electronically.

.5 Complete the inspection forms in the entirety and include them in the individual inspection and test report.

.6 Submit electronic PDF copies of the inspection forms.

.7 The scope of work required in the Specifications is in no way limited by the inspection forms or spaces provided. Provide additional pages, documents, and forms as required to provide a complete individual inspection and test report.

.8 The inspection forms may be updated during the Work by the City or the Contract Administrator. Utilize the latest forms provided.

.9 Perform insulation resistance temperature correction calculations utilizing the following:

.1 To correct to 20°C, utilize Table 260805-1.

.2 To correct to 40°C, utilize Table 260805-2.

Table 260805-1

Insulation Resistance Correction Factors (20 °C)

Measured Temperature (°C)	Oil Immersed Insulation	Solid Insulation
-10	0.125	0.25
-5	0.18	0.32
0	0.25	0.40
5	0.36	0.50
10	0.50	0.63
15	0.75	0.81
16	0.80	0.85
17	0.85	0.89
18	0.90	0.92
19	0.95	0.96
20	1.00	1.00
21	1.08	1.05
22	1.16	1.10
23	1.24	1.15
24	1.32	1.20
25	1.40	1.25
30	1.98	1.58
35	2.80	2.00
40	3.95	2.50
45	5.60	3.15
50	7.85	3.98
55	11.20	5.00
60	15.85	6.30

Table 260805-2

Insulation Resistance Correction Factors (40 °C)

Measured Temperature (°C)	Oil Immersed Insulation	Solid Insulation
-10	0.03	0.10
-5	0.04	0.13
0	0.06	0.16
5	0.09	0.20
10	0.13	0.25
15	0.18	0.31
16	0.19	0.33
17	0.21	0.34
18	0.22	0.36
19	0.24	0.38
20	0.25	0.40
21	0.27	0.42
22	0.29	0.44
23	0.31	0.46
24	0.33	0.48
25	0.35	0.50
30	0.50	0.63
35	0.71	0.79
40	1.00	1.00
45	1.41	1.26
50	2.00	1.59
55	2.83	2.00
60	4.00	2.52

.3 Perform winding resistance temperature correction calculations utilizing the following:

.1 $$R_C = R_M \frac{T_C + T_K}{T_M + T_K}$$

.2 Where, R_C = Resistance at corrected temperature.

R_M = Resistance at measured temperature.
T_C = Temperature to correct to in °C.
T_M = Measured temperature in °C.
T_K = Temperature Resistance Constant
(234.5 °C for copper, 226.0 °C for aluminum)

3.3 CABLES, < 1000 V (ALSO FEEDERS IN CONDUIT)

.1 Inspection and testing shall be comprised of the following:

.1 For cables/wires 4/0 AWG or larger, inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate and correct values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.2 Torque all accessible bolted electrical connections.

.3 Inspect compression applied connectors for correct cable match and indentation.

.4 Inspect grounding and cable/conduit support.

.5 Verify that visible cable bends meet or exceed the minimum allowable bending radius.

.6 Measure length of cable/conduit and record in meters.

.7 If cables/wires are terminated through window-type current transformers, inspect to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.

.8 Perform an insulation-resistance test on each conductor. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute. Investigate resistances less than 1000 megaohms. The voltage applied shall be 500 Vdc for 300 V rated cables, and 1000 Vdc for 600 V or 1000 V rated cables.

3.4 CONTROL POWER TRANSFORMERS, < 1000 V

.1 Inspection and testing shall be comprised of the following:

.1 Record the equipment nameplate data for inclusion in the individual inspection and test report.

.2 Inspect physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.

.3 Verify that primary and secondary fuse ratings or circuit breakers match available Drawings. Where Drawings are not available, note fuses that appear to be sized incorrectly, based upon application of the Canadian Electrical Code. Mark fuse sizes and type on the Drawings, where not shown.

.4 Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be:

.1 windings < 250 V: 500 Vdc

.2 windings > 250 V: 1000 Vdc

3.5 CURRENT INSTRUMENT TRANSFORMERS

.1 Inspection and testing shall be comprised of the following:

.1 Record the equipment nameplate data for inclusion in the individual inspection and test report.

.2 Inspect physical and mechanical condition.

.3 Ensure that CT shorting bars are removed or installed as required.

.4 Verify that current circuits are grounded and have only one grounding point in accordance with ANSI/IEEE C57.13.3.

.5 Perform an insulation resistance test of the current transformer primary and secondary windings, and wiring to ground at 1000 Vdc. Do not perform this test on solid-state devices. Investigate any resistance values less than 25 megaohms.

.6 Perform a polarity test of each current transformer in accordance with ANSI/IEEE C57.13.1.

.7 Perform a ratio-verification test using the voltage or current method in accordance with ANSI/IEEE C57.13.1. Note any ratio accuracies not within 0.5% of nameplate or manufacturer's published data.

.8 Perform an excitation test on transformers used for protection or relaying applications in accordance with ANSI C57.13.1.

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3.6 MOTORS, INDUCTION, AC, 600 V

.1 Inspection and testing shall be comprised of the following:

.1 Record the equipment nameplate data for inclusion in the individual inspection and test report.

.2 Inspect physical and mechanical condition.

.3 Inspect anchorage, alignment, and grounding.

.4 Inspect air baffles, filter media, cooling fans, slip rings, brushes, and brush rigging. Air baffles and filter media should be clean. Cooling fans should operate. Slip ring wear and brushes should be within manufacturer's tolerances for continued use. Brush rigging should be intact.

.5 Clean the unit.

.6 Inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.7 Verify the application of appropriate lubrication and lubrication systems.

.8 Verify the absence of unusual mechanical or electrical noise or signs of overheating.

.9 Perform a rotation test to insure correct shaft direction.

.10 Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43. Test voltage shall be in accordance with manufacturer's published data or 500 Vdc.

.1 Where possible, test each winding separately. Ground all windings not under test.

.2 Ensure all cables and accessories are disconnected during the test.

.3 For motors <= 150kW (200 HP), the test duration is to be one (1) minute. Calculate the dielectric absorption ratio.

.4 For motors > 150kW (200 HP), the test duration is to be ten (10) minutes. Calculate the dielectric absorption ratio and polarization index.

.5 Correct test results to 40 °C.

.6 Investigate readings below 100 megaohms. Investigate dielectric absorption ratios less than 1.4 and polarization index ratios less than 2.0 for Class B insulation and Class F insulation.

.11 Where it is not possible to perform an insulation resistance test separately on each winding, perform a winding resistance test on each winding using a low-resistance ohmmeter.

.12 Measure running voltage and current and evaluate relative to load conditions and nameplate full-load amperes. Utilize a true RMS meter.

.1 Where powered by a VFD with bypass, perform test with the motor powered by the VFD and by the bypass starter.

.13 Perform insulation-resistance test on insulated bearings in accordance with manufacturer's published data, if applicable.

.14 Perform resistance tests on resistance temperature detector (RTD) circuits. RTD circuits should conform to design intent and/or machine protection device manufacturer's specifications.

3.7 MOTOR STARTERS, 600 V

.1 Inspection and testing shall be comprised of the following:

.1 Record the equipment nameplate data for inclusion in the individual inspection and test report.

.2 Record all adjustable settings, size of overload, etc.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage, alignment, and grounding.

.5 Verify the unit is clean.

.6 Torque all accessible bolted power connections.

.7 Inspect contactors for evidence of overheating or stress.

.8 Visually inspect and exercise circuit breaker.

.9 If power fuses are present, record fuse size and type. Measure the resistance of each fuse. Investigate inconsistent resistance values.

3.8 VARIABLE FREQUENCY DRIVE, 120V

.1 Inspection and testing shall be comprised of the following:

.1 Record the equipment nameplate data for inclusion in the individual inspection and test report.

.2 Record all adjustable settings, size of overload, etc.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage, alignment, and grounding.

.5 Verify the unit is clean.

.6 Torque all accessible bolted power connections.

.7 Inspect contactors for evidence of overheating or stress.

.8 Visually inspect and exercise circuit breaker.

.9 If power fuses are present, record fuse size and type. Measure the resistance of each fuse. Investigate inconsistent resistance values

.2 Record the following VFD Parameters:

.1 Motor voltage, current, frequency, nominal speed, nominal power.

.2 Control mode / method.

.3 Minimum and maximum control frequency.

.4 Acceleration and deceleration time.

.5 Compare drive overcurrent set points with motor full-load current rating to verify correct settings.

.3 Power fuses:

.1 Record fuse data. Confirm that the fuses are of the correct type and rating. Utilize manufacturer's published data where available.

.2 Measure fuse resistance.

.4 Bolted connections:

.1 Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.2 Torque all bolted connections.

.5 Inverter / Supply Module Power Connections:

.1 Remove each power module and visually inspect the contacts.

.2 Torque all cable connections.

.3 Clean all contact surfaces and apply suitable joint compound as recommended by manufacturer.

.6 Operator Interface:

.1 Check the display and keypad for proper operation and communication.

.2 Retrieve fault history log and note any faults.

.7 Grounding/Bonding measurements:

.1 Measure the resistance of the ground bonding connection between the VFD and the main grounding bus in the corresponding electrical room.

.8 Control Wiring:

.1 Check for tightness of all accessible control wiring and torque any loose connections.

.9 Perform operational tests by initiating control devices.

.1 Slowly vary drive speed between minimum and maximum. Observe motor and load for unusual noise or vibration.

.2 Verify operation of drive from local start/stop and speed control signals.

.3 Verify operation of all local pilot lights.

.4 Verify the operation of any emergency stop switches.

.10 Voltage and Current Testing:

.1 With the VFD under load, measure and record the following:

.1 Measure and record incoming AC voltage and currents.

.2 Measure and record DC and AC bus voltages.

.2 Utilize a recording oscilloscope to capture the input voltage waveform and verify correct operation.

.3 Utilize a recording oscilloscope to capture the output voltage waveform and verify correct operation.

.4 Include input and output waveforms with the report.

.11 With the VFD output in START/RUN mode, and at zero speed:

.1 Measure and record the AC output voltage. Voltages above 40 VAC should be investigated.

.12 Affix an inspection sticker or inspection tag to each VFD in an appropriate place so that it will be conspicuous to all authorized personnel. This inspection notice must include, but is not limited to, equipment identifier, testing company name, date of inspection and the inspector's name. The sticker shall not obscure any equipment nameplates, readouts, or indicators.

3.9 CIRCUIT BREAKERS, INSULATED-CASE/MOLDED CASE, 600 V

.1 Inspection and testing shall include the following:

.1 Record the equipment nameplate data for inclusion in the individual inspection and test report.

.2 Record all adjustable settings.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage and alignment.

.5 Clean the unit.

.6 Torque all accessible bolted power connections.

.7 Operate the circuit breaker to insure smooth operation.

.8 Test all breakers utilizing the "Push-To-Trip" button, if equipped.

.9 Move operating handle to the off and on position.

.10 Restore breaker position to original position.

.2 For cables 4/0 AWG and larger, inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.3 For breakers with a frame size greater or equal to 250A, or as specified elsewhere in the Specification:

.1 Perform an insulation resistance test.

.2 Breakers rated < 600V, test voltage is to be 500 VDC.

.3 Breakers rated >= 600V, test voltage is to be 1000 VDC.

.4 Perform a contact/pole-resistance test.

.5 milliohms.

3.10 FIRE ALARM SYSTEM

.1 Perform fire alarm Verification Inspection V.I, and submit report indicating the entire system is operational, and completely functional.

.2 Test and document central reporting functionality of the system.

.3 Test and submit documentation in accordance with the latest of:

.1 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.

.2 CAN/ULC-S537, Verification of Fire Alarm Systems.

3.11 MAKE UP AIR UNIT (AHU-C601, AHU-C602)

.1 Perform testing in accordance with the manufacturer's instructions and recommendations.

.2 The vendor shall provide a trained technician to provide the site commissioning and start-up of the scrubber.

.3 Provide commissioning test forms completed by vendor. Final test forms shall be type written.

.4 Perform a load cycle of the air handling unit. on site.

3.12 CHLORINE SCRUBBER (SCRB-C670)

.1 Perform testing in accordance with the manufacturer's instructions and recommendations.

.2 The vendor shall provide a trained technician to provide the site commissioning and start-up of the scrubber.

.3 Provide commissioning test forms completed by vendor. Final test forms shall be type written.

.4 Perform a load cycle of the scrubber on site.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).
- .2 CSA C9, Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.3 PRODUCT DATA

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

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No.47.

.2 600V Primary Transformers:

- .1 Type: ANN.
- .2 Phase and kVA as indicated on the drawings, 600V input, Output as per drawings, 60 Hz.
- .3 Voltage taps: 2.5% and 5% full capacity above and below normal.
- .4 Windings: copper.
- .5 Insulation: Class H, 220ºC.
- .6 Temperature rise: 115ºC at continuous full load.
- .7 Basic Impulse Level (BIL): 10 kV.
- .8 Hipot: 4kV.
- .9 Average sound level: To meet the local municipal & building codes and meet at minimum the following criteria:
  45 dB max. up to 45 kVA
  50 dB max. up to 150 kVA
- .10 Impedance at 170 degrees C: standard
- .11 Overload capability: Short-term overload per IEEE C57.96.
- .12 K-Factor power transformer in accordance with IEEE C57.110.
- .13 Enclosure:

.1 CSA enclosure type 3R, type 4, type 4X, type 12 or other as indicated on the drawings

.2 Exterior finish: ANSI 61 gray

.14 Refer to the ~~drawings~~ Drawings for the preferred transformer mounting method.

.1 Where wall mounting is specified, provide the required manufacturer approved wall mount kit. Ensure that wall mounts are connected to the building structure, and that the facility is designed to handle the loads.

.2 Where floor mounting is specified via note or placement, provide 3.5" thick concrete housekeeping pad below transformer, extend the pad under the footprint of the transformer, plus a minimum of 2" beyond the transformer enclosure in all direction.

.3 Other mounting methods, such as steel transformer supports to be as detailed on the drawings or as approved by the Contract Administrator.

.15 Nameplate to include actual transformer impedance (%Z).

.16 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Label size: 7.

.3 Nameplate for each transformer, example as follows:

XFMR-C670 45 kVA, 600 – 480V, 3Ø, 3W FED FROM MCC-C710

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers as indicated on the drawings. Provide brackets and bolts for wall mounted transformers. Ensure all transformers have good ventilation.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

.4 Install non-combustible insulating board, extending 300mm around transformer on all sides, behind transformer to meet CEC code requirements.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Mount transformers to reduce direct and transmitted noise. Mount core and coils of transformers.

.9 Make connections to transformers in flexible conduit, entering the enclosure below the coils.

.10 Provide suitable ground and bond cables / connections to the transformer (even though this may not be explicitly shown on the drawings) in accordance with code requirements. For 3-phase, star grounded secondary transformers:

1. Provide a separate green insulated ground conductor to the transformer star connection. Minimum size is #6 AWG in accordance with the CEC. Run ground conductor in a separate conduit, back to the main ground. Ensure conduit is bonded to ground at both ends, and electrically continuous.
2. Provide a separate green insulated bond conductor connected to the enclosure frame, sized in accordance with CEC.

.11 Energize transformers after installation is complete.

.12 Adjust tap connections to give a continuous rated secondary voltage, under load.

3.2 TESTING

.1 Utilize test form provided. Complete test form in full.

.2 Perform tests in accordance with Section 26 08 05 – Acceptance Testing.

.3 Measure and record the voltage on the primary and secondary of the transformer. Adjust the tap position as required. Record final tap position and voltage.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates, and their installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

Part 2 Products

2.1 SWITCHES – TWO POSITION, SINGLE POLE

.1 15 A, 120 V, single pole switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually operated heavy duty ac switches with following features:

.1 Heavy duty mounting strap.

.2 Terminal holes approved for No. 10 AWG wire.

.3 Silver alloy contacts.

.4 One piece lexan toggle, lever, and cam.

.5 Suitable for back and side wiring.

.6 Green hex head grounding terminal.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Weatherproof for switches located outside.

.6 NEMA 4X rated for switches located in chlorine rooms.

.7 Acceptable manufacturer:

.1 Hubbell or approved equal in accordance with B7.

2.2 SWITCHES – TWO POSITION, DOUBLE POLE

.1 15 A, 120 V, double pole switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually operated heavy duty ac switches with following features:

.1 Heavy duty mounting strap.
.2 Terminal holes approved for No. 10 AWG wire.
.3 Silver alloy contacts.
.4 One piece lexan toggle, lever, and cam.
.5 Suitable for back and side wiring.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Weatherproof for switches located outside.

.5 NEMA 4X rated for switches located in chlorine rooms

.6 Switches of one manufacturer throughout project.

.7 Acceptable manufacturer:

.1 Hubbell or approved equal in accordance with B7.

2.3 DUPLEX RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, heavy duty specification grade to: CSA-C22.2 No.42 with following features:

.1 Heavy duty nylon face with steel reinforcing plate in centre.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Receptacle contacts to utilize spring steel clips to reduce contact fatigue.

.2 Receptacles of one manufacturer throughout project.

.3 Equipped weatherproof box for Category 2 compliance.

.4 Acceptable manufacturer:

.1 Hubbell 8200 or approved equal in accordance with B7.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 All receptacles and light switches shall be equipped with weatherproof boxes in the Chlorine Buildings at Hurst, MacLean, and McPhillips Pumping Stations;

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

- .1 Install single throw switches with handle in "UP" position when switch closed.
- .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Receptacles:

- .1 Install duplex receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Install welding receptacles in accordance with manufacturer’s recommendations. Mount at 1200mm above finished floor (to bottom of receptacle).
- .3 Mount duplex receptacles vertically.
- .4 Mount duplex receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Cover plates:

- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Install a permanent label or lamacoid for all wiring devices indicating the circuit(s) contained within.

- .1 Example: C711-2 (Panelboard PNL-C711, circuit 2)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers and circuit breakers.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

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

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers and circuit breakers to CSA C22.2 No. 5.

.2 Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

.3 Circuit breakers shall have an over center, trip free, toggle operating mechanism which shall provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.

.4 All breakers to be bolt-on style. Push on style, or stab-lok breakers will not be accepted.

.5 Breakers to be mounted using manufacturer approved breaker mounting accessories.

.6 Common-trip breakers: with single common handle for multi-pole applications.

.7 Branch circuit breakers shall have a minimum interrupting capacity as indicated on the Drawings. Breakers shall have the same interrupting rating as that indicated for the panelboard, on the panelboard schedules. Series rated breakers will not be accepted.

.8 Moulded case circuit breakers shall operate automatically by means of trip element devices to provide inverse time current tripping.

.9 The circuit breaker handle shall reside in a tripped position between on and off to provide local trip indication. Circuit breaker escutcheon shall be clearly marked on and off.

.10 Protective devices shall be suitable for use with 75°C or greater wire insulation systems and Canadian Electrical Code 75°C conductor ampacity.

.11 The maximum ampere rating, CSA standards with applicable voltage systems and corresponding interrupting ratings, shall be clearly marked on the face of the circuit breaker.

.12 Circuit breakers shall be factory sealed, with an installed hologram quality mark and shall have a date code on the face of the circuit breaker.

.13 All equipment and components must be supplied through a manufacturer approved distribution channel. Equipment shall be supported, guaranteed, and traceable through the equipment manufacturer channels. Equipment procured from an unauthorized third party will be rejected.

.14 Breakers shall be manufacturer approved, tested, and CSA approved for use within the panelboard or distribution equipment that it is installed within.

.15 Acceptable manufacturer: Schneider Electric or approved equal in accordance with B7.

2.2 TRIP UNITS

.1 Trip elements to be as follows:

.1 Breakers sized less than 100A shall be equipped with thermal magnetic trip elements, unless indicated otherwise on the Drawings.

.2 Breakers sized 100A and greater shall have electronic, fully adjustable trip elements, unless indicated otherwise on the Drawings.

.3 Fully adjustable, electronic LSIG, LSI, LI, are to be provided as indicated on the Drawings.

.4 Switchgear, panelboards, CDPs, MCC and motor starter breakers shall utilize breakers by Schneider Electric based on the City of Winnipeg standards, with ratings in accordance with the single line Drawings.

.5 Meet the requirements of the CEC and the Drawings with respect to ground fault protection.

.2 Electronic trip units:

.1 Trip system shall be a Micrologic electronic trip unit with true RMS sensing.

.2 Current transformers shall be used to ensure accurate measurements from low current up to high currents.

.3 The following monitoring functions shall be integral parts of electronic trip units:

.1 A test connector shall be installed for checks on electronic and tripping mechanism operation using an external device.

.2 LED for load indication at 105 percent.

.3 LED for load indication at 90 percent of load for applications 600A and smaller.

.4 LED for visual verification of protection circuit functionality for applications 600A or smaller.

.5 LED for trip indication for applications above 600A.

.4 Micrologic trip unit functions shall consist of fully adjustable protection settings with the capability to be set and read locally by rotating a switch.

.1 Long-time pickup shall allow for adjustment to nine long-time pickup settings. This adjustment must be at least from 0.4 to 1 times the sensor plug (In), with finer adjustments available for more precise settings to match the application.

.2 Adjustable long-time delay shall be in nine bands. At six times Ir, from 0.5 to 24 seconds above 600A, and 0.5 to 16 seconds for 600A and below.

.3 Short-time pickup shall allow for nine settings from 1.5 to 10 times Ir.

.4 Short-time delay shall be in nine bands from 0.1–0.4 I^2t ON and 0–0.4 I^2t OFF.

.5 Instantaneous settings on the trip units with LSI protection shall be available in nine bands.

.1 Above 600A, from 2 to 15 times In

.2 600A, from 1.5 to 11 times In

.3 400A from 1.5 to 12 times In

.4 250A and below, from 1.5 to 15 times In

.6 Ground fault settings for circuit breaker sensor sizes 1200 amperes or below shall be in nine bands from 0.2 to 1.0 times In. The ground fault settings for circuit breakers above 1200 amperes shall be nine bands from 500 amperes to 1200 amperes.

.5 24V power supply for electronic trip breakers to be internal to panelboard.

.6 Electronic components shall withstand temperatures up to 221 °F (105 °C).

.3 Accessories

.1 General:

.1 Circuit breakers shall be equipped with ULC listed electrical accessories as noted on the Drawings or schedules.

.2 The addition of auxiliaries shall not increase the overall mounting size of the circuit breaker.

.3 The addition of mechanisms shall not mask or block device settings.

.2 Electrical auxiliaries: electrical auxiliaries, such as voltage releases (shunt and undervoltage releases) and indication switches as follows:

.1 Same field-installable auxiliary contacts for signaling different functions, such as open/ closed position, fault signal, electrical fault (including electrical leakage) signal.

.2 Electrical auxiliaries shall be separated from power circuits.

.3 Electrical auxiliaries shall be of the snap-in type and fitted with terminal blocks.

.4 Electrical auxiliary function and terminals shall be permanently engraved on the case of the circuit breaker and the auxiliary itself.

2.3 ACCESSORIES

.1 All main and branch breakers in switchgear are to include a permanently fixed attachment for padlocking the breakers in the OFF position.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers within equipment.

.2 Circuit breaker pickup level and time delay settings shall be adjusted to values indicated by the coordination study, and as instructed by the Contact Administrator.

.3 Identification: In accordance with Section 26 05 01 – Common Work Results – Electrical, provide lamacoid plate on or adjacent to each breaker showing load being fed.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, Enclosed Switches.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets and include product characteristics, performance criteria (including interrupting rating), enclosure rating, and limitations.

.3 Spare Parts:

.1 Submit spare parts as described in Part 2.1.8 of this section and in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 CSA approved.

.2 Disconnect switches to be heavy duty, horsepower (motor) rated.

.3 Size to accommodate the required loads. Minimum sizes as indicated on Drawings.

.4 Disconnect switches shall be CSA enclosures type 2 (for interior dry, clean areas) and CSA enclosure type 4X (for exterior or wet area). Refer to drawings for specified ratings.

.5 Mechanically interlocked door to prevent opening when handle in ON position.

.6 Disconnects for motor loads to be heavy duty, motor rated.

.7 Disconnect switches shall have the appropriate interrupting rating (kAIC). Minimum rating is 10 kAIC. For interrupting ratings greater than 10 KAIC, utilize fused disconnects.

.8 Provide fuses as indicated on the Drawings (or as needed to increase the kAIC rating). Provide 3 spare fuses for every type.

.9 Provision for padlocking in on-off switch position.

.10 Switch mechanism: quick-make, quick-break action with self-wiping contacts.

.11 For switches 100A and over, provide non-tracking arc shrouds.

.12 Solderless pressure lugs for cable connectors.

.13 All switch poles to operate together, simultaneously with a common operating bar.

.14 Highly visible ON-OFF switch position indication on switch enclosure cover.

2.2 APPROVED MANUFACTURERS.

.1 Schneider Electric, Eaton, Hubbell or approved equal in accordance to B7.

.2 All disconnect switches to be of one manufacturer for the entire project. Split packages (multiple vendors) will be rejected.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches.

.2 Connect line and load cables to all disconnect switches.

.3 Connect electrode ground to ground terminal within service entrance rated disconnect switches.

.4 Ensure neutral-ground bonding link is installed in service entrance rated disconnect switches.

.5 Install fusing.

.6 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.7 Indicate equipment identifier, as shown on the Drawings, on size 4 nameplate.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Provide Shop Drawings for each type of starter to indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout and components.

.4 Enclosure type.

.5 Wiring diagrams

.6 Terminal block layout and connections

1.2 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for each type and style of motor in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit spare parts as indicated in part 2.8 of this section and in accordance with Section 01 78 00 – Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Starters: to NEMA ICS 2-2000.

.2 Equipment Identification:

.1 Refer to Section 26 05 01 – Common Work Results - Electrical

.2 Colour: White nameplate, black letters.

.3 Text Size: 8mm high letters.

.4 Text as shown on the Drawings.

.3 Control Wiring:

.1 Tin Plated Copper, 16 AWG, TEW unless otherwise indicated.

.4 Wire Identification:

.1 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram. Markings are to be computer generated.

.5 Device Identification:

.1 Door-mounted indicating lights, push buttons, selector switches, as indicated on the Drawings. Identification to be lamacoids.

.2 On the door interior, install identification labels adjacent to each pilot device containing the identifier of the pilot device (e.g. HS-C6410). The identification is to be provided by a lamacoid.

.3 Internal components such as contactors and relays must be identified by a lamacoid. Relays composed of a base and removable relay are to be identified on the base or enclosure back-panel rather than on the removable relay component.

.6 Finishes:

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.

.1 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 UL/CSA listed, NEMA size as shown on the Drawings.

.1 Smallest size of starter: NEMA size 1, unless otherwise indicated

.2 IEC rated starters are not acceptable.

.2 Magnetic of size, type, rating, and enclosure type as indicated with components as follows:

.1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed 25 kA.

.2 Combination style motor starter, with instantaneous overcurrent protection, starter contactor, overload protection.

.3 All coils to be epoxy coated.

.4 Transient suppressors shall be supplied for all coils in each individual starter unit.

.5 Contactor solenoid operated, rapid action type.

.6 Wiring and schematic diagram inside starter enclosure in visible location.

.7 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.8 Transient suppressors shall be supplied for all coils in each individual starter unit.

.9 Motor overload protective device in each phase, manually reset from outside enclosure.

.10 Wiring and schematic diagram inside starter enclosure in visible location.

.11 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.3 Accessories:

.1 Selector switches: heavy-duty oil tight labelled as indicated.

.2 Indicating lights: heavy-duty oil tight type and color as indicated.

.3 1-N/O spare auxiliary contact.

.4 Approved manufacturers:

.1 Schneider TeSys or approved equal in accordance with B7.

2.3 MOTOR STARTER ACCESSORIES.

.1 Control Transformers:

.1 Single phase, dry-type, with 600V primary and 120V secondary, complete with primary and secondary fusing, installed in enclosure with soft starter, as indicated.

.2 Calculate required size of the control transformer. The size shown on the Drawings is the minimum size. Provide size as required for appropriate operation of the starter, plus 20% spare capacity.

.2 Interval Timing Relays:

.1 Interval timing relay automatically switches state when energized and switches back to steady state after timing period lapses.

.2 Relay contact shall switch back to steady state while coil remains energized indefinitely.

.3 120 VAC, 60 Hz coil.

.4 Din rail mountable.

.5 Pins: 8.

.6 Power supply start.

.7 Time delay setting:

.1 Adjustable: 0.1 - 60 seconds.

.2 Rotary analog.

.8 Relay Outputs:

.1 Form B contacts: Quantity 1.

.2 Rated for 120 VAC, 60Hz.

.9 Acceptable products:

.1 Omron H3CR-A8E complete with Omron PF085A.

.3 Pilot Devices:

.1 Pushbuttons and selector switches: Heavy-duty, oil tight, NEMA rated, 30 mm, labelled as indicated.

.2 Indicating lights: Heavy-duty, oil tight, NEMA rated, 30 mm, LED bulb, type and color as indicated.

.3 Start pushbuttons to utilize a green cap and stop pushbuttons to utilize a red cap.

.4 Documentation:

.1 Provide door pocket with complete set of drawings for each starter.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with primary and secondary fuses, installed in with starter as indicated.

.2 Size control transformer as indicated and as necessary to support the system controls.

2.5 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight as required.

.2 Selector switches: heavy duty, oil tight as required.

.3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results -Electrical.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Starter designation label, white plate, black letters, size 5 or larger as needed to accommodate 8MM text, engraved to indicate the equipment tag, as well as the equipment description.

2.8 SPARE PARTS

.1 Fuses: two of each rating.

.2 Two indicating lamp bulbs of each type.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses are installed.

.4 Confirm motor nameplate and adjust / replace overload device to suit.

3.2 MOTOR STARTER TESTING

.1 Perform complete testing of motor starter operation,

.2 Submit test results to the Contract Administrator.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 08 05 – Acceptance Testing and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Technical requirements related to the design and supply of Variable Frequency Drives (VFD), including all equipment, manufacture, assembly, factor, wiring, inspection, testing and delivery.

1.2 REFERENCES

.1 CSA, Canadian Standards Association

.2 NEMA, National Electrical Manufacturer Association

.3 IEEE, The Institute of Electrical and Electronics Engineers

.4 Other, Local Power Utility and Telephone Utility Guidelines for Harmonic Distortion.

1.3 DESIGN REQUIREMENTS

.1 Voltage: 120V

.2 Single phase

.3 Power: Minimum 1.5 HP

.4 The VFD will be installed in the Contractor designed motor starter panel MS-C641. Contractor to provide shop drawing of panel which will include the VFD. Ensure proper ventilation is provided for starter panel

.5 Equipped with fault single capable of being wired to a local PLC system for status.

.6 Manual speed control capability

1.4 SUBMITTALS

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

.2 Submit shop drawings including:

.1 Panel layout.

.2 Wiring diagrams:

.1 AutoCAD versions of the VFD schematic drawings will be provided upon request.

1.5 PARTS AVAILABILITY

.1 Guarantee that parts for the drive units be available for a minimum of ten years from time of delivery.

1.6 DESIGN REQUIREMENTS

.1 Ventilation system designed for ambient temperature range of 10°C to 35°C. Enclosure temperature not to exceed 45°C.

Part 2 Products

2.1 VARIABLE FREQUENCY DRIVES

.1 Product shall be suitable for asynchronous induction motor.

.2 Variable speed controller shall be electronic adjustable frequency and voltage output unit.

.3 Harmonic loading will not exceed a motor service factor of 1.0.

.4 Products shall comply with IEEE standard 519.

.5 CSA certified.

.6 Input frequency setting signal will be 0-10 VDC and 4-20 mA. Output speed and current monitoring signals will be 4-20 mA.

.7 Enclosure

.1 Installed in Contractor designed motor starter panel for Exhaust EF-C641 at MacLean Pumping Station. Refer to design drawing 1-0630M-E0080.

.8 As supplied by one of the following acceptable manufacturers:

.1 ABB – ACS255 series.

.2 Or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 VFD cabinets shall be mounted in such a way that there is adequate room for ventilation and no build up of heat. The minimum clearance in front of VFDs is 1 m.

3.2 CONFIGURATION

.1 Contractor responsible for configuring the VFD. Contractor shall consult with manufacturer for suitable settings for application.

.2 Review the settings and modify the settings as required for the drive supplied.

.3 Include settings sheets in the O&M manuals.

3.3 TESTS

.1 VFD units are to be factory tested prior to shipment. Provide confirmation from factory of actual tests completed and results.

.2 Confirm VFD capability to continue operation without coming to a standstill, following any momentary voltage dips in the input power supply, auxiliary power supply or both of less than 20% rated voltage, which last for less than 0.5 seconds.

.3 Field testing

.1 Provide on-site startup, fine-tuning, commissioning, operator training, and instruction.

.2 Full-load functional test of the VFD shall be performed. The test shall prove the correct operation of all control functions, auxiliaries, protective systems, alarms and metering.

.3 Ensure shaft to ground voltages do not exceed 1.5 V at any speed or load requirement.

.4 Provide all completed test forms as required by the vendor.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4-02(R2007), Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.

.1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International).

.5 ICES-005-07, Radio Frequency Lighting Devices.

.6 Underwriters' Laboratories of Canada (ULC).

.7 IESNA LM-79 and LM-80

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

Part 2 Products

2.1 LUMINAIRES

.1 Refer to luminaire schedule on the Drawings for acceptable products.

.2 Luminaires and all related controls equipment must be CSA approved.

.3 Minimum complete, replacement - 5 year warranty on all components.

.4 Compliance with IESNA LM-79 and LM-80.

2.2 LED DRIVERS

.1 All new luminaires shall be LED type, with LED drivers.

.2 Long life, 60,000 hours minimum.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 LUMINAIRES

.1 Acceptable manufacturers and models:

.1 As indicated in luminaire schedule on the Drawings.

.2 Or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated on the Drawings.

.2 Provide adequate supports to suit ceiling and wall mounted luminaires. Provide fixture mounting kits in accordance with manufacturer recommendations.

.3 Replace any fixtures damaged throughout the construction.

.4 Install a permanent label or lamacoid for all luminaires indicating the circuit(s) contained within.

.1 Example: C711-11 (Panelboard PNL-C711, circuit 11).

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Provide wiring to luminaires run in conduit system, refer to section 26 05 34 - Conduits, Conduit Fastenings, and Fittings.

.2 Provide separate bonding conductor.

.3 Provide separate neutral for all lighting circuits.

3.3 LUMINAIRE SUPPORTS

.1 Support luminaires in accordance with manufacturer recommendations and in accordance with the drawings.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

.2 Waste management: separate waste materials for recycling.

.3 Clean lenses and remove dust / debris from the luminaires.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141 (2015), Unit Equipment for Emergency Lighting.

1.3 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power, and special attachments.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 VAC.

.3 Output voltage: 12 VDC.

.4 Operating time: as shown in schedule on Drawings.

.5 Provide “autotest” feature for all battery banks.

.6 Battery: sealed, maintenance free.

.7 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.8 Solid state transfer circuit.

.9 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.10 Signal lights: solid state, for ‘Fault”.

.11 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED.

.12 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.13 Finish: white.

.14 Auxiliary equipment:

.1 Test switch.

.2 Battery disconnect device.

.15 NEMA 4X rated.

.16 Acceptable manufacturers and models:

.1 As indicated on the Emergency Lighting Schedule, located on the Drawings.

.2 Or approved equal in accordance with B7.

2.2 WIRING OF REMOTE HEADS

.1 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized 10 AWG or greater to accommodate voltage drop.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures in locations indicated on the Drawings.

.2 Demonstrate emergency lighting operation and coverage for the full duration run time, in the presence of the Contract Administrator.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Government of Canada

.1 NBC (Latest), National Building Code of Canada.

.2 ISO 8201, Acoustics – Audible Emergency Evaluation Signal.

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524, Installation of Fire Alarm Systems.
.2 ULC-S525, Audible Signal Appliances for Fire Alarm.
.3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
.4 CAN/ULC-S527, Control Units.
.5 CAN/ULC-S528, Manual Pull Stations.
.6 CAN/ULC-S529, Smoke Detectors.
.7 CAN/ULC-S530, Heat Actuated Fire Detectors.
.8 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.
.9 CAN/ULC-S537, Verification of Fire Alarm Systems.

.4 NFPA 720 – Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment.

.5 NFPA 13 – Standard for the Installation of Sprinkler Systems.

.6 CSA C22.1 Canadian Electrical Code.

.7 Manitoba Building Code.

.8 Winnipeg Electrical By-law.

1.2 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in Multiplex Fire Alarm System:

.1 BPS – Booster Power Supply
.2 DCLA – Data Communication Link Style A
.3 DCLB – Data Communication Link Style B
.4 DCLC – Data Communication Link Style C
.5 DGP – Data Gathering Panels
.6 FACP – Fire Alarm Control Panel
.7 FAAP – Fire Alarm Annunciator Panel
.8 IDC – Initiating Device Circuit

.9 NAC – Notification Appliance Circuit

.10 N/O – Normally Open

.11 SLC – Signaling Line Circuit

.12 CO – Carbon Monoxide

1.3 SYSTEM DESCRIPTION

.1 Fully supervised, microprocessor based, fire alarm system, utilizing digital techniques for data control and digital multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions including; receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; and initiating trouble signals.

.3 Zoned, non-coded single stage.

.4 Modular in design to allow for future expansion.

.5 System to be operable by personnel not requiring special computer skills.

.6 Provide all components required for a full and functioning fire alarm system. Not all devices, modules, end of line resistors, relays, etc. are shown on the Drawings. The Contractor is responsible for all components for a complete and working system.

.7 System to include but not limited to:

.1 Chubb Edwards addressable microprocessor based fire alarm central control unit. This includes but is not limited to: the main system memory, input output interfaces for alarm receiving, local annunciation/display, and program control/signaling, battery backup.

.2 Remote annunciator in separate enclosure with input output interfaces for alarm receiving and annunciation/display.

.3 Power supplies.

.4 Initiating/input circuits.

.5 Output circuits.

.6 Auxiliary circuits.

.7 Wiring.

.8 Manual and automatic initiating devices.

.9 Audible and visual signaling devices.

.10 Addressable relay modules.

.11 End of line resistors.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System components: listed by ULC and comply with applicable provisions of National Building Code and Local/Provincial Building Code and meet requirements of local authority having jurisdiction.

1.5 DESIGN REQUIREMENTS

.1 The Contractor shall design conduit layout and wiring interconnection of all devices and systems.

.2 Perform voltage drop calculations and upsize wiring from what is shown on the Drawings or indicated in the Specifications, as required in order to comply with the CEC.

.3 The microprocessor based fire alarm panel shall be suitable for connection of all new fire alarm devices, plus 100% spare devices on each loop.

1.6 SHOP DRAWINGS AND SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 26 05 01- Common Work Results – Electrical.

.2 Include:

- .1 Descriptive product information for each individual system component including Manufacturer's name, model number, ratings, and power requirements.
- .2 Dimensional drawings of panels and associated equipment.
- .3 Itemized bill of material complete with part numbers.
- .4 Operating and programming instructions.
- .5 Complete point-to-point wiring diagrams of the system and device interconnection.
- .6 Supervisory power requirement calculations.
- .7 Alarm power requirement calculations.
- .8 Battery sizing calculations.
- .9 Voltage drop calculations for wiring runs.
- .10 Conduit fill calculations.
- .11 Detail assembly and internal wiring diagrams for control panels and annunciator panel.
- .12 Overall system riser diagram identifying control equipment, initiating zones, and signaling circuits; identifying terminations, terminal numbers, conductors, and raceways.
- .13 Details and performance specifications for control, annunciation, and peripherals with item by item cross reference to Specification for compliance.
- .14 Recommended types and quantities of spare parts.
- .15 Written schedule of active and spare addresses on each addressable circuit.

.3 Provide informational submittals including:

- .1 Service technician certifications.
- .2 Code-enforcement authority approval letter.

1.7 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for fire alarm system for incorporation into operation and maintenance manuals specified in Section 01 78 00 - Closeout Procedures.

.2 Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Written documentation for logic modules as programmed.

.3 System program hard copy on flash drive.

.4 Documentation of system voltage, current, and resistance readings taken during system installation and testing.

.5 NFPA 72, Record of Completion: Submit to Contract Administrator and AHJ.

.6 NFPA 72, Inspection and Testing Form: Submit to Contract Administrator and AHJ.

.7 Technical data - illustrated parts lists with parts catalogue numbers.

.8 Copy of approved Shop Drawings with corrections completed and marks removed except review stamps.

.9 List of recommended spare parts and provision of spare parts for system.

1.8 QUALITY ASSURANCE

.1 Qualifications

.1 A technician with a minimum engineering technologist certification for fire alarm systems or a professional engineer registered in Province of Manitoba shall be available on-site.

.2 Service technician shall be formally trained by the fire alarm manufacturer.

.2 Regulatory Requirements

.1 Submit Shop Drawings and system design calculations for approval to the AHJ.

1.9 EXTRA MATERIALS

.1 Include:

.1 2 extra keys for all enclosures, including but not limited Fire Alarm Control Panels (FACP) and resetting/opening manual pull stations.

1.10 TRAINING

.1 Provide on-site training sessions by the fire alarm equipment manufacturer to train operational and maintenance personnel in the use and maintenance of the system. See Part 3.5 for more details.

1.11 INSPECTION

.1 Inspection to conform to CAN/ULC-S536. Submit inspection report to the Contract Administrator.

.1 No additional payment for the inspections will be made. Include all costs in the base price for the fire alarm system.

Part 2 Products

2.1 GENERAL

.1 Not all devices or modules are necessarily listed below. Provide any other components required for a complete and working fire alarm system.

.2 Acceptable Manufacturers:

.1 Edwards System Technology;

.2 or approved equal in accordance with B7.

.3 ULC Compliance

.1 Products manufactured within the scope of ULC shall conform to ULC standards and have a ULC listing mark.

.4 CSA Approval

.1 All electrical equipment shall be CSA approved.

2.2 MATERIALS

.1 Equipment and devices: ULC listed and labeled and supplied by single Manufacturer.

.2 Power supply: to CAN/ULC S524.

.3 Audible signal devices: to ULC S524.

.4 Visual signal devices: to CAN/ULC S526.

.5 Control unit: to CAN/ULC S527.

.6 Manual pull stations: to CAN/ULC S528.

.7 Thermal detectors: to CAN/ULC S530.

.8 Smoke detectors: to CAN/ULC S529.

.9 Smoke alarms: to CAN/ULC S531.

2.3 SYSTEM OPERATION: SINGLE STAGE SIGNALS ONLY

.1 Actuation of any alarm initiating device to:

.1 Indicate zone of alarm at central control units and remote annunciator.

.2 Cause audible signaling devices to sound continuously throughout facility and at central control unit.

.3 Cause indicated HVAC to shut down to provide required control of smoke movement.

.4 Indicate alarm and trouble signals to plant operations PLC system.

.5 Acknowledging alarm: indicated at central control units and remote annunciator.

.6 Possible to silence signals by "alarm silence" switch at control unit, after 60s period of operation.

.7 Subsequent alarm received after previous alarm has been silenced, to re activate signals.

.8 Actuation of supervisory devices to:

.1 Indicate respective supervisory zone at central control unit and at remote annunciator.

.2 Cause audible signal at central control unit to sound.

.3 Activate common supervisory sequence.

.4 Resetting alarm device not to return system indications/functions back to normal until control unit has been reset.

.9 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer, and common trouble sequence. Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.

.10 Trouble on system: suppressed during course of alarm.

.11 Trouble condition on any circuit in system not to initiate alarm conditions.

2.4 CONTROL PANELS

.1 Requirements:

.1 Provide new single stage addressable fire alarm control panels. Provide all devices, accessories, and programming to accommodate the expansion of the system.

.2 Fire alarm control panel shall include:

.1 Indicating circuits;

.2 Notification circuits;

.3 Auxiliary Relays;

.4 Data Connection to Remote Annunciator; and

.5 24 VDC power output to Remote Annunciator.

.3 Provide additional required indications at the control panels, including but not limited to:

.1 Supervisory alarm;

.2 Alarm for each zone;

.3 Trouble for each zone;

.4 Alarm signaling circuit trouble;

.5 Annunciator circuit trouble;

.6 Remote annunciator trouble; and

.7 Signals silenced

.4 Auxiliary Relays:

.1 Plug-in type, supervised against unauthorized removal by common trouble circuit. Terminals capable of accepting 12-22 AWG wire.

.5 Acceptable manufacturer: Edwards iO1000 Intelligent Fire Alarm System, equivalent Notifier system, or approved equal in accordance with B7.

2.5 REMOTE BOOSTER POWER SUPPLIES

.1 Provide power supplies to ensure functional devices. Power supplies are not shown on the Drawings.

2.6 ADDRESSABLE CONTROL MODULES

.1 Distributed throughout the facility in suitable electrical boxes and interconnected to the control panel utilizing multiplex data transmission techniques.

.1 Mounted in rooms with suitable environmental conditions or else installed in mounting box providing sufficient environmental protection.

.2 Control and monitor conventional notification appliance circuit via interface to addressable, intelligent device loop.

.1 Control and activate one Class B NAC, as commanded by the control panel.

.2 Relay trouble status of NAC to the control panel.

.3 Provide external power supply to power devices on the NAC circuit.

.3 Module address to be set on module in the field or electronically by loop controller.

2.7 ADDRESSABLE RELAY MODULES

.1 Distributed throughout facility in suitable electrical boxes and interconnected to the control panel utilizing multiplex data transmission techniques.

.1 Mounted in rooms with suitable environmental conditions, or else installed in mounting box providing sufficient environmental protection.

.2 Close one Form C dry contact as commanded by the control panel.

.1 Suitable for shutting of HVAC supply fan. Each fan will require individual relay module.

.3 Module address to be set on module in the field or electronically by loop controller.

.4 Acceptable Material: Edwards SIGA-CRH, equivalent Notifier device, or approved equal in accordance with B7.

2.8 ADDRESSABLE MONITOR MODULES

.1 Distributed throughout facility in suitable electrical boxes and interconnected to CCU utilizing multiplex data transmission techniques.

1. Mounted in rooms with suitable environmental conditions or else installed in mounting box providing sufficient environmental protection.

.2 Provide interface between standard alarm input devices and FACP.

1. Each addressable monitor module to monitor one conventional Class B IDC and relay alarm and trouble condition of detectors on the circuit back to FACP.

.3 Module address to be set on the module in the field or electronically by loop controller.

.4 Acceptable Material: Edwards model SIGA-UM, equivalent Notifier device, or approved equal in accordance with B7.

2.9 POWER SUPPLIES

.1 120 V, 60 Hz as primary source of power for system.

.2 Voltage regulated, current limited distributed system power.

.3 Primary power failure or power loss will activate common trouble sequence.

.4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.5 During normal operating conditions, fault in battery charging circuit, short, or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.6 Standby batteries: sealed, maintenance free.

.7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.10 INITIATING/ INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, and heat detectors, wired in DCLA, DCLB, or DCLC configuration to control panels as shown on Drawings.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation" in Section 2.3.

.4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA or DCLC configuration to FACPs as shown.

.5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation" in Section 2.3.

2.11 ALARM OUTPUT CIRCUITS

.1 Alarm output circuit: connected to signals, wired in class B configuration to control panels as shown.

.1 Signal circuits' operation to follow system programming; capable of sounding horns. Each signal circuit: rated at 2 A, 24 VDC; fuse protected from overloading/overcurrent.

.2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

2.12 AUXILIARY CIRCUITS

.1 Auxiliary contacts for control functions.

.2 Alarm on system to cause operation of programmed auxiliary output circuits.

.3 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

2.13 WIRING

.1 Fire Alarm Cable (FAS)

.1 Use:

.1 Initiating Device Circuits (IDC).

.2 Notification Appliance Circuits (NAC).

.3 Data Communication Link Circuits (DCL).

.2 Cable: to CAN/CSA C22.2 No. 208-03.

.1 Rated FAS 105.

.3 Conductors:

.1 Twisted, stranded copper, with overall shield and tinned copper drain wire.

.2 Notification circuit conductors: stranded copper, minimum 12 AWG.

.3 Initiating Device Circuit conductors: stranded copper, minimum 16 AWG, twisted, stranded, copper with shield.

.4 Data Communication Link circuit conductors: stranded copper, minimum 16 AWG.

.4 Insulation:

.1 PVC.

.2 Voltage Rating: 300.

.3 Fire Rating: FT4.

.5 Acceptable Manufacturer:

.1 Belden or approved equal in accordance with B7.

.2 Building Wires

.1 Use:

.1 Control circuits.

.2 Requirements:

.1 As per Section 26 05 21- Wires and Cables (0-1000V).

.2 Minimum size: 14 AWG minimum and in accordance with manufacturer's requirements.

.3 Raceway

.1 Refer to Section 26 05 34 - Conduits, Conduit Fasteners, and Fittings.

2.14 MANUAL ALARM STATIONS

.1 Provide station manufacturer's approved back box for each manual alarm station.

.1 Station colour: red.

.2 Conventional manual alarm stations: pull lever, wall mounted surface type, non-coded, single pole normally open contact for single stage. English signage.

.3 Restoration to require use of key.

.1 Keys: identical throughout system for stations and control panels. New keys are to match the existing installation so that all keys are common throughout.

.4 Where weatherproof stations are required, provide stations with weatherproof housings with hinged access doors suitable for NEMA 4X compliance.

.2 Addressable manual pull station.

.1 Pull lever, surface wall mounted type, single action, single stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to

supply power to station. Station address to be set on station in field or electronically by loop controller.

.2 Restoration to require use of key.

.1 Keys: identical throughout system for stations and control panels. New keys are to match the existing installation so that all keys are common throughout.

.3 Acceptable Materials: Edwards models SIGA-270 or approved equal in accordance with B7 for unclassified areas.

.4 Acceptable Materials: Edwards models MPSR1 or approved equal in accordance with B7 for NEMA 4X areas.

2.15 AUTOMATIC ALARM INITIATING DEVICES

.1 Conventional Heat Detector, Fixed Temperature

.1 Non restorable, rated for at least 90 degrees C.

.2 Supplied with metal mounting plate.

.3 ULC rated for 12.2m spacing or greater

.4 Alarm indication.

.5 Acceptable Materials: Edwards model CF200-2, equivalent Notifier device, or approved equal in accordance with B7.

.2 Addressable heat detectors, fixed temperature.

.1 Non restorable, rated 57 degrees C unless indicated otherwise.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector in field or electronically by loop controller.

.4 Plug in type with fixed base.

.5 Wire in base assembly with integral red alarm LED.

.6 Spot type: ULC rated for 15.2m spacing or greater.

.7 Acceptable Material: Edwards model SIGA-HFD, equivalent Notifier device, or approved equal in accordance with B7.

.3 Addressable heat detectors, rate of rise.

.1 Self-restoring, rated 8.3 degrees C per minute.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector in field or electronically by loop controller.

.4 Plug in type with fixed base.

.5 Wire in base assembly with integral red alarm LED.

.6 Spot type: ULC rated for 15.2m spacing or greater.

.7 Acceptable Material: Edwards model SIGA-HRD, equivalent Notifier device, or approved equal in accordance with B7.

.4 Heat detectors, high humidity, rate of rise.

.1 Self-restoring, rated 8.3 degrees C per minute.

.2 Suitable for use in high humidity indoor environments and areas that subject to potential corrosive elements, spray washing, and below freezing temperatures.

.3 Spot type: ULC rated for 22m spacing or greater.

.5 Addressable smoke detector.

.1 Optical Smoke Detector.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector in field or electronically by loop controller.

.4 Plug in type with fixed base.

.5 Wire in base assembly with integral red alarm LED.

.6 Spot type: ULC rated for 9.1m spacing or greater.

.7 Acceptable Material: Edwards model SIGA-OSD, equivalent Notifier device, or approved equal in accordance with B7.

.6 Conventional Smoke Detector, Nema 4X Rated.

.1 Optical Smoke Detector

.2 Suitable for use for 24VDC

.3 Nema 4X Rated complaint

.4 Wire in base assembly with integral alarm LED Alarm indication

.5 Spot type: ULC rated for 9.1m spacing or greater. FM approved is acceptable as well.

.6 Acceptable Materials: Edwards/Kidde model 30-3013 or approved equal in accordance with B7

2.16 FAULT ISOLATOR MODULES

.1 General:

.1 Provide fault isolator modules to automatically isolate wire-to-wire short circuits on an SLC loop.

.2 Isolator module to automatically open-circuit (disconnect) the SLC loop on a wire-to wire short. Upon the short circuit condition being corrected, the isolator module is to automatically reconnect the isolated section of the SLC loop.

.2 Requirements:

.1 Address setting not to be required.

.2 Completely automatic operation.

.3 It shall not be necessary to replace or reset the fault isolator module after its normal operation.

.4 Mounting:

.1 A standard 54 mm (2-1/8") deep x 102 mm (4") square electrical box,

.2 Surface-mounted backbox, or

.3 the Fire Alarm Control Panel.

.5 A single LED which shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

.6 Provide isolator complete with mounting plate and cover.

.3 Acceptable Material: Edwards model SIGA-IM, or approved equal in accordance with B7.

2.17 COMBINATION AUDIBLE / VISUAL SIGNAL DEVICES

.1 General

.1 Utilize the ISO 8201 Clause 4.2 Temporal Tone standard for all signalling devices to indicate an alarm signal.

.2 Horn / Strobes – Unclassified Locations:

.1 24 VDC.

.2 Strobe type: flashing, Refer to Drawings for brightness settings (15 cd, 30 cd, 75cd, or 110cd).

.3 Designed for surface mounting on walls

.4 Acceptable Materials: Edwards models G4AVRF, or approved equal in accordance with B7.

.3 Horn / Strobes – NEMA 4X Locations:

.1 24 VDC.

.2 Strobe type: flashing, 24 VDC. Refer to Drawings for brightness settings (15 cd, 30 cd).

.3 Designed for surface mounting on walls

.4 Acceptable Material: Edwards model outdoor rated Genesis Led WGAVRF Series, or approved equal in accordance with B7.

2.18 VISUAL ALARM SIGNAL DEVICES

.1 Strobes – Unclassified Locations:

.1 Strobe type: flashing, 24 VDC. Refer to Drawings for brightness settings (15 cd, 30 cd, 75cd, or 110cd).

.2 Designed for surface mounting on walls.

.3 Means provided to synchronize flashes within corridors or rooms in the same field of view.

.4 Acceptable Material: Edwards model G4VRF, or approved equal in accordance with B7.

.2 Strobes – NEMA 4X Locations:

.1 Strobe type: flashing, 24 VDC. Refer to Drawings for brightness settings (15 cd, 30 cd).

.2 Designed for surface mounting on walls.

.3 Means provided to synchronize flashes within corridors or rooms in the same field of view.

.4 Acceptable Material: Edwards model outdoor rated Genesis Led WGVRF Series, or approved equal in accordance with B7.

.3

2.19 END OF LINE DEVICES

.1 End of line devices to control supervisory current in notification appliance circuits and nonaddressable signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short, or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at the FACPs and remote annunciator.

.2 Secure identifying label to the front of the cover plate, listing the zone served.

.3 Where weatherproof end of line devices are required, provide stations with weatherproof housings with hinged access doors.

.4 Acceptable Material: Edwards model EOL-P1 or approve equal in accordance with B7.

2.20 REMOTE ANNUNCIATORS

.1 Remote annunciator in main building entranceway.

.2 LCD text annunciator with common controls.

.3 Remote expander LED zone annunciation.

.4 Enclosure for remote annunciator and expander.

.5 Acceptable Manufacturer: Edwards RLCD-C Annunciator c/w with RLED24 Remote Expander in a RA-ENC2 Enclosure, or approved equal in accordance with B7.

2.21 AS BUILT DIAGRAM

.1 Update and provide new fire alarm system riser diagram: in glazed frame, minimum size 432 by 279 mm, mounted adjacent to annunciator panel. New documentation shall include the existing systems as well as the new systems.

.2 Updated and provide new facility base plans, indicating locations of zones, including room number labels: in glazed frame, minimum size 432 by 279 mm, mounted adjacent to annunciator panel.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC S524, manufacturer's instructions and recommendations, and in accordance with applicable codes and standards.

.2 Install manual alarm stations and connect to alarm circuit wiring.

- .1 Mount stations with operating lever/ring at 1.3 m above finished floor.
- .2 Affix a notice to the wall near each manual station indicating that the alarm is local only and instructing occupants to phone 911 in case of fire.

.3 Provide all mounting accessories and devices as required in order to suit the location shown on the Drawings. The Drawings and Specifications do not specifically indicate all required manufacturer approved mounted accessories.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 450 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to FACPs.

.6 Install horns and visual signal devices and connect to signaling circuits. Visual signals and combination visual devices must be installed at the elevations dictated by CAN/ULC S524.

.7 Connect signalling circuits to FACPs.

.8 Install end of line devices as required at end of conventional NACs and IDCs.

- .1 End-of-line devices to be in a separate enclosure, mounted less than 1800mm AFF.

.9 Install remote annunciator panel and connect to main control panel for DC power. Connect to FACPs via data communications network.

.10 Install remote relay units to control fan shut down.

.11 Splices are not permitted.

.12 Provide necessary conduit, cable, and wiring to make interconnections to terminal boxes, annunciator equipment, and FACPs as required by equipment manufacturer.

.13 Ensure that wiring is free of opens, shorts, or grounds before system testing and handing over.

.14 Mount end-of-line resistors on terminal blocks.

.15 Identify circuits and other related wiring at FACPs, remote annunciator, and terminal boxes.

.16 Tie in existing Carbon Monoxide detection signal to fire alarm panel at. The carbon monoxide detection shall have its own zone. Refer to drawings for tie in details.

.17 Install identifying lamicoids adjacent to each device on all signalling circuits and initiating circuits, including each manual alarm station, automatic alarm initiating device, audible signal device, visual alarm signal device, and end-of-line device. Label each device in the format FAS-x-yyy, as shown in the Drawings. Identifying lamicoids are to have white lettering on a red background.

.1 Submit lamicoid label lettering to Contract Administrator prior fabrication and installation.

3.2 CONDUIT

.1 Install separate raceway system for the fire alarm system, independent of all other wiring.

.2 Conduit fill not to exceed 40%.

.3 Install pull boxes in each conduit at intervals not to exceed 30m. Pull boxes to be 100 mm square, minimum.

.4 Paint pull boxes, junction boxes, conduit bodies, and terminal cabinets red prior to installation. Provide touch-up painting prior to final acceptance testing.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 08 05 – Acceptance Testing and CAN/ULC standards.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal, smoke, and flame detectors transmit alarm to control panel and actuate general alarm and ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on (new or modified) alarm and signalling circuits to ensure proper operation of systems.

.4 Addressable circuits system style DCLA:

.1 Test each conductor on all (new or modified) DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all (new or modified) DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.5 Addressable circuits system style DCLB:

.1 Test each conductor on all (new or modified) DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open circuit fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all (new or modified) DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

3.4 MOUNTING HEIGHTS

.1 Mount fire alarm equipment at heights specified or, if not specified, as indicated in the latest of CAN/ULC S524.

3.5 DEMONSTRATION AND TRAINING

.1 Provide on site lectures and demonstration by fire alarm equipment manufacturer of any fire alarm system components that do not match existing to train operational personnel in use and maintenance of fire alarm system.

.2 Prepare two classroom training session for City Operations personnel. Topics to be focussed on system functionality and operation, with a highlight on changes made to the existing system. Training sessions will not be on successive days and will be scheduled by the City.

.3 Prepare two classroom training session for City Electrical Maintenance personnel. Minimum duration to be three hours. Training sessions will not be on successive days and will be scheduled by the City. Topics to be focussed on but not limited to:

.1 System functionality and operation;
.2 Resetting of devices;
.3 Alarms;
.4 Remote notification;
.5 Troubleshooting and maintenance; and
.6 Overview of the panels and devices being used.

.4 Prepare and distribute appropriate training manual for use and reference during training sessions

.5 Training material shall be sent to the Contract Administrator for approval at least two (2) weeks prior to the commencement of the training sessions.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials, applications, installation, and verification for excavating, trenching, and backfilling.

1.2 REFERENCES

.1 City of Winnipeg (CW)

.1 CW3110 – Sub-Grade, Sub-Base, and Base Course Construction.
.2 CW3135 – Supply and Installation of Geogrid.
.3 CW3170 – Earthwork and Grading.
.4 CW3230 – Full-Depth Patching of Existing Slabs and Joints.
.5 CW3410 – Asphaltic Concrete Pavement Works.
.6 CW3520 – Seeding.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.
.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
.5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.4 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
.1 CSA-A3001, Cementitious Materials for Use in Concrete.
.2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

1.3 DEFINITIONS

.1 Rock: any solid material in excess of 1 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with a 0.95 to 1.15 m^3 bucket. Frozen material is not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.3 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.4 Topsoil:

- .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
- .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 mm in any dimension.

.5 Waste material: excavated material unsuitable for use in the Work or surplus to requirements.

.6 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of the Work.

.7 Unsuitable materials:

- .1 Weak, chemically unstable, and compressible materials.
- .2 Frost susceptible materials:
  - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136:
  - .2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

.8 Sub-grade: the natural in-situ material.

.9 Base course: the layer of material immediately underlying the pavement.

1.4 SUBMITTALS

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

.2 Submit an excavation plan to the Contract Administrator for review at least two weeks prior to commencement of the Work.

.3 Upon request, submit material test results to the Contract Administrator a minimum of two weeks before excavation begins.

Part 2 Products

2.1 MATERIALS

.1 Base Course Materials

.1 Base course material to be approved by the Contract Administrator.

.2 Base course material to consist of sound, hard, crushed rock or crushed gravel and to be free from organic or soft material that would disintegrate through decay or weathering.

.3 The base course material to be well graded and conform to the following grading requirements:

Canadian Metric	Percent of Total Dry Weight Passing each Sieve	
Sieve Size	Granular	Crushed Limestone
25 000	100%	
20 000	80-100%	100%
5 000	40-70%	40-70%
2 500	25-50%	25-60%
315	13-30%	8-25%
80	5-15%	6-17%

.4 Base course material when subjected to the abrasion test to have a loss of not more than 35% when tested in accordance with grading B of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.5 The material passing the 315 sieve to have a liquid limit not greater than 25 and a plasticity index not greater than 6.

.6 Where base course is being placed under an asphaltic concrete pavement, the aggregate retained on a No. 5 000 sieve to contain not less than 35% crushed aggregate as determined by actual particle count. Crushed aggregate to be considered as that aggregate having at least one fractured face.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice, and snow from surfaces to be excavated within limits indicated.

3.2 EXCAVATION

.1 Locate underground services prior to commencing the work, and protect them at all times during construction.

.2 Hydrovac and expose all affected underground services prior to commencing the work.

.3 Excavate and properly dispose off-site in-situ material to the depth to accommodate the concrete or paving, as shown on the Drawings or as directed by the Contract Administrator.

.4 Hand trim, make firm, and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.5 Dispose of surplus suitable site material and unsuitable material such as frost heaving clays, silts, rocks, and rubble as per Section 3.2.5 of this section.

.6 Strip and stockpile topsoil from the Site in a manner which will prevent contamination of topsoil with underlying soil materials. Dispose of excess materials.

.7 During excavation, the Contractor will be advised by the Contract Administrator as to which areas have an unsuitable sub-grade. Extend the excavation either to the lower limit of the unsuitable material or to a depth as directed by the Contract Administrator.

.8 Remove wooden poles, concrete bases, abandoned foundations, tree stumps and roots encountered under new pavement and as shown on the Drawings to the top of subgrade or 1 m below the bottom of the pavement surface, whichever depth is greater.

.9 Backfill and compact over-excavated areas in accordance with the specifications.

3.3 PREPARATION OF SUB-GRADE

.1 Compact the sub-grade after the bottom of the excavation has been approved by the Contract Administrator.

.2 Compact areas of suitable sub-grade material, the full width of the excavation, to a minimum of 98% Standard Proctor Density.

3.4 QUALITY OF SUB-GRADE AND BASE COURSE LAYERS

.1 Determine the Standard Proctor Density for the sub-grade and base course materials at the optimum moisture content in accordance with ASTM Standard D698. The field density of each sub-grade and base course layer will be a percentage of the applicable Standard Proctor Density.

.2 Utilize quality control tests to determine the acceptability of the sub-grade and base course layers, as placed and compacted before the succeeding layer may be applied.

.3 Contractor to verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D1556, Test for Density of Soil in Place by the Sand-Cone Method, or ASTM Standard D2922, Test of Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth). Provide documentation to the Contract Administrator.

.4 The frequency and number of tests will be as directed by the Contract Administrator.

.5 Promptly fill holes made by the removal of samples from the layers with appropriate material and thoroughly compact so as to conform in every way with the adjoining material.

3.5 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while the Work is in progress.

.2 Protect open excavations against flooding and damage due to surface run-off.

.3 Dispose of water in a manner not detrimental to public and private property, or portion of the Work completed or under construction.

.1 Provide and maintain temporary drainage outside of excavation limits.

3.6 BACKFILLING

.1 Vibratory compaction equipment is required. Obtain approval from the Contract Administrator prior to preforming work. Ensure that adjacent or nearby structures are not damaged in any way.

.2 Do not proceed with backfilling operations until completion of following:

.1 The Contract Administrator approved installations construction below finished grade.

.2 Inspection, testing, approval, and recording location of underground utilities.

.3 Removal of concrete formwork.

.4 Backfilling of voids with satisfactory fill as required.

.3 Areas to be backfilled to be free from debris, snow, ice, water, and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow, or debris.

.5 Place backfill material in uniform layers not exceeding 100 mm compacted thickness. Compact each layer before placing succeeding layer.

.6 Backfilling around installations.

.1 Place bedding and surround materials.

.2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed soil retaining Work to equalize loading. Difference not to exceed 150 mm.

3.7 RESTORATION

.1 Prior to construction, inspect the grassed, pavement, and gravel surfaces within and adjacent to the Site with the Contract Administrator to record the current condition. After construction and site cleanup is complete, re-inspect the condition with the Contract Administrator.

.2 Restoration of grassed areas removed or damaged as result of construction activities will be restored in accordance with CW 3520. Restoration of grassed areas will not be measured for payment and shall be included as part of the Work being done.

.3 Pavement damaged or removed as a result of construction activities will be restored in accordance with CW3230 and CW 3410. Restoration of the pavement will not be measured for payment and shall be included as part of the Work being done.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section covers items common to sections of Division 40. This section supplements the requirements of Division 1.

1.2 CODES AND STANDARDS

.1 Complete installation in accordance with latest CSA C22.1 except where specified otherwise.

.2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

1.3 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.3 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

1.4 CARE, OPERATION, AND START-UP

.1 Instruct City maintenance and operating personnel in the operation, care, and maintenance of systems, system equipment, and components.

.2 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 all aspects of its care and operation.

1.5 PERMITS, FEES, AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of Drawings and Specifications for examination and approval prior to commencement of Work.

.2 Pay associated fees.

.3 Notify the Contract Administrator of changes required by Electrical Inspection Department and Supply Authority prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from Electrical Inspection Department and Supply Authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department and Supply Authority.

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified. Minimum enclosure type in Category 2 areas is NEMA 4X.

1.7 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

1.8 EQUIPMENT IDENTIFICATION

.1 Identify equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic lamicoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

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	20 x 200 mm	1	8 mm high letters
Size 7	25 x 100 mm	1 line	12 mm high letters
Size 8	25 x 100 mm	2 lines	6 mm high letters
Size 9	35 x 100 mm	3 lines	5 mm high letters
Size 10	35 diameter	1 line	5 mm high letters

.3 Wording on nameplates to be approved by the Contract Administrator prior to manufacture.

.4 Allow for average of 25 letters per nameplate.

.5 Identification to be English.

1.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of all conductors and circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

.2 Wire tags to be legible and visible after the system is installed (ie/ not blocked).

1.10 SUBMITTALS

.1 Provide submittals as indicated in the individual Specifications and in accordance with 01 33 00 – Submittal Procedures and 01 78 00 – Closeout Submittals.

1.11 AS-BUILT AND RECORD DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during the Work, including all addenda, change orders, site instructions, clarifications, and revisions for the purpose of recording all changes in the Work. As the Work on-site proceeds, the Contractor shall clearly record in red pencil all as-built conditions, which deviate from the original Contract. As-Built and Record Drawings to include circuiting of all devices, conduit, and feeder runs (complete with conductor size and number) and locations of all electrical and automation equipment.

1.12 OPERATION AND MAINTENANCE MANUALS

.1 Operation and Maintenance Manuals

.1 Refer to Section 01 78 00 – Closeout Submittals for general operation and maintenance manual requirements.

.2 In addition to the general requirements, provide the following information:

.1 Table of Contents – Arrange contents sequentially by systems under Section numbers. Label tabs of dividers between each to match section numbers in the Table of Contents.

.2 Systems Descriptions – A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.

.3 Manuals containing all pertinent information, drawings, and documents of the Contractor's supply and/or documentation included with the instruments supplied by others, such as:

.1 Mechanical drawings of the equipment.

.2 Installation drawings and procedures.

.3 Instrument model numbers.

.4 Equipment specifications.

.5 Detailed utility requirements.

.6 Replacement parts list with model numbers.

.7 Recommended preventative maintenance frequency.

.8 Troubleshooting procedures.

.9 Procedures for dismantling.

.10 Procedure to operate the equipment/instruments.

.11 Recommended cleaning procedure.

.12 Recommended list of supplies to be used in conjunction with the operation and maintenance of the equipment.

.13 Recommended spare parts list.

.4 A copy of all wiring diagrams completes with wire coding.

.5 Include type and accuracy of instruments used.

.6 Set of final reviewed Shop Drawings.

.7 Testing documentation including:

.1 Loop check report.

.2 Factory Acceptance Test (FAT) report.

.3 Site Acceptance Test (SAT) report.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Manitoba Building Code (MBC).

.2 The following is a list of standards which may be referenced in this section:

.1 Factory Mutual.

.2 Institute of Electrical and Electronics engineers, Inc (IEEE): 515, Testing, Design, Installation and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications.

.3 National Electrical Manufacturers' Association (NEMA): 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Underwriters Laboratories, Inc. (UL).

1.2 DESIGN REQUIREMENTS

.1 Design equipment, anchorage, and support systems for vertical and lateral loading in accordance with MBC.

.2 Refer to Electrical Drawings for the scope and technical specification for pipe heat tracing.

1.3 SUBMITTALS

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

.2 Submit written certification from Professional Engineer licensed in the Province of Manitoba stating that support systems, anchorage, and equipment have been designed according to requirements of the National Building Code of Canada (NBC). Specifically, the design shall meet the requirements of NBC for post-disaster structures at time of Shop Drawing submittals.

.3 Action Submittals: Shop Drawings:

.1 Manufacturer's descriptive literature.

.2 Plastic Pipe Installations: Output adjustment factors for heating tape for the services indicated.

.3 Pipe heat loss calculations for each pipe size to be heat traced.

Part 2 Products

2.1 REFER TO ELECTRICAL DRAWINGS

Part 3 Execution

3.1 INSTALLATION

.1 General:

.1 Install in accordance with the manufacturer's instructions and recommended practices.

.2 Provide insulation as specified in Section 40 42 13, Piping Insulation, over all pipe heat tracing.

.3 Ground metallic structures or materials used for support of heating cable or on which it is installed in accordance with applicable codes.

.4 Wiring between power connection points of heat tracing cable branch lines shall be provided by heat tracing system supplier.

.5 Provide end of circuit pilot lights on heat tracing circuits for buried piping.

.2 Electrical Heating Tape:

.1 Determine required length of electrical heating tape by considering length of circuit, number and type of fittings and fixtures, design heating load, and heating tape output.

.2 Where design heating load exceeds heating tape capacity, install by spiraling.

.3 Derate heating tape capacity when installed on plastic piping.

.4 Install additional heating tape at bolted flanges, valves, pipe supports, and other fittings and fixtures as recommended by supplier, but not less than the following:

Item	**Heating Tape Length**
Bolted flanges (per pair)	Two times pipe diameter
Valves	Four times valve length
Pipe hanger or support penetrating insulation	Three times pipe diameter

.3 Heat Tracing Circuits:

.1 Limit individual lengths of heat tracing circuits such that maximum single circuit capacity is 20 amps when starting the circuit at 5 degrees C.

.2 Provide multiple 20-amp circuits as required at individual heat tracing locations.

.4 Thermostats:

.1 Install in accordance with manufacturer's instructions and as approved by Contract Administrator.

3.2 FIELD QUALITY CONTROL

.1 Test each circuit with a minimum 500-Volt insulation tester from phase to ground, with neutrals isolated. Insulation Resistance: Minimum 1000 megohms per 300 meters.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Comply with the latest edition of the following statutes codes and standards and all amendments thereto.

.1 American Society of Heating, Refrigerating and Air Conditioning Engineers Inc. (ASHRAE): 90.1, Energy-Efficient Design of New Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM):

.1 C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by means of the Guarded-Hot-Plate Apparatus.

.2 B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 C518, Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.4 C533, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.5 C534, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

.6 C547, Standard Specification for Mineral Fiber Pipe Insulation.

.7 C552, Standard Specification for Cellular Glass Thermal.

.8 C585, Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

.9 C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

.10 C1729, Standard Specification for Aluminum Jacketing for Insulation.

.11 E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

.12 E96, Test Methods for Water Vapor Transmission of Materials.

.3 International Code Council (ICC) International Energy Conservation Code (IECC).

.4 Underwriters Laboratories Inc. (UL).

.5 Underwriters Laboratories of Canada (ULC).

1.2 SUBMITTALS

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

.2 Action Submittals:

.1 Shop Drawings: Manufacturer’s descriptive literature.

.3 Informational Submittals: Maintenance information.

Part 2 Products

2.1 PIPE INSULATION

.1 Type 1:

.1 Material: Flexible elastomeric pipe insulation, closed cell structure in accordance with ASTM C534.

.2 Temperature Rating: Minus 40 degrees C to 82 degrees C.

.3 Nominal Density: 96 kg/m^3.

.4 Conductivity in accordance with ASHRAE 90.1 and minimum of 24 degrees C per ASTM C177 or ASTM C518.

.5 Minimum water vapor transmission of 5.75 ng/Pa·s·m^2 per ASTM E96.

.6 Joints: Manufacturer's adhesive.

.7 Flame Spread Rating: Less than 25 per ASTM E84.

.8 Manufacturers and Products:

.1 Rubatex; Insul-Tube 180 or Insul-Sheet 1800 or approved equal in accordance with B7.

.2 Armstrong; Armaflex AP or approved equal in accordance with B7.

.2 Type 2:

.1 Material: UL-rated, preformed, sectional rigid fiberglass with factory applied, Kraft paper with aluminum foil vapor barrier jacket with pressure-sensitive, self-sealing lap.

.2 Temperature Rating: Minus 18 degrees C to 455 degrees C.

.3 Conductivity in accordance with ASHRAE 90.1 and minimum of 0.039 w/m·degrees C.

.4 Minimum water vapor transmission for jacket of 1.15 ng/Pa·s·m^2 per ASTM E96.

.5 Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.

.6 Manufacturers and Products:

.1 Owens-Corning Fiberglass; ASJ/SSL-11.

.2 Manville; Micro-Lock 650 with AP-T Jacket,

.3 Or approved equal in accordance with B7.

.3 Type 2A – Flexible Blanket, Nonjacketed, High Temperature:

.1 Description: Roll form complying with ASTM C553.

.2 Thermal Conductivity: 0.27 at 24 degrees C mean temperature.

.3 Nonjacketed.

.4 Density: 2 pcf.

.5 Maximum Operating Temperature: 538 degrees C.

.6 Acceptable Manufacturers:

.1 Johns Manville HTB 23.

.2 Owens Corning – Fiber Glass TTW Type 1.

.3 Knauf Fiber Glass GmbH Type ET.

.4 Or approved equal in accordance with B7

.4 Type 3:

.1 Material: Cellular glass.

.2 Temperature Rating: Minus 179 degrees C to 482 degrees C.

.3 Following manufacturer's direction based upon temperature of piping to be insulated.

.4 Manufacturer and Product: Pittsburgh Corning; FOAMGLAS, or approved equal in accordance with B7.

.5 Type 4:

.1 Material: Calcium silicate, minimum density of 192 kg/m^3, maximum K factor of 0.066 W/m·degrees C at 149 degrees C mean (ASTM C533), without factory-applied jacket.

.2 Temperature Rating: 649 degrees C, maximum.

.3 Manufacturers and Products:

.1 Owens/Corning Fiberglass; Kaylo 10.

.2 Schuller (Manville); Thermo-12.

.3 Calsilite; 1,200-degree thermal insulation.

.4 Or approved equal in accordance with B7.

.6 Type 5 – Noise Insulation for Pipes and Ducts:

.1 Material: Foil faced mass loaded vinyl noise barrier bonded to 50 mm

.2 quilted fiberglass sound absorber. 2 pounds per square foot noise

.3 barrier.

.4 Temperature Rating: Minus 25 degrees C to 150 degrees C.

.5 Class A Fire Rating.

.6 Sound Reduction: 20 decibels.

.7 Manufacturers: Sound Seal Corp, or approved equal in accordance with B7.

2.2 ROOF DRAIN AND OVERFLOW DRAIN SUMPS INSULATION

.1 Type 1: 25 mm thick.

2.3 FITTING INSULATION

.1 Type 1: Same as pipe.

.2 Type 2:

.1 Wired in-place premolded insulation or mitered segments, or soft fiberglass insulation inserts covered with premolded 20-mil minimum thickness PVC fitting covers.

.2 Manufacturers:

.1 Manville Zeston.

.2 CEEL-CO.

.3 Knauf-Proto.

.4 Or approved equal in accordance with B7.

.3 Type 3: Same as pipe.

2.4 INSULATION AT PIPE HANGERS AND SUPPORTS

.1 Refer to Section 40 05 15, Piping Support Systems.

.2 Type 1:

.1 Copper and Nonmetallic Pipe 50 mm and Smaller and Steel Pipe 40 mm and Smaller: Use insulation shields.

.2 Larger Sizes: Use insulation saddles or Type 3 rigid insulation insert 250 mm long.

.3 Type 2:

.1 UL-rated, preformed rigid pipe insulation inserts of thickness equal to adjoining insulation, 250 mm in length, with factory applied, vinyl-coated and embossed vapor barrier jacket with self-sealing lap.

2.5 INSULATION FINISH SYSTEMS

.1 Type F1 – PVC:

.1 Polyvinyl chloride (PVC) jacketing, white, for straight run piping and fitting locations, temperatures to 70 degrees C.

.2 Manufacturers and Products:

.1 Knauf; Proto.

.2 Johns Manville; Zeston.

.3 Or approved equal in accordance with B7.

.2 Type F2 – Paint:

.1 Acrylic latex paint, white, and suitable for outdoor use.

.2 Manufacturers and Products:

.1 Armstrong; WB Armaflex finish.

.2 Rubatex; 374, white finish.

.3 Or approved equal in accordance with B7

.3 Type F3 – Aluminum:

.1 Aluminum Roll Jacketing: For straight run piping, wrought aluminum Alloy 3003, 5005, 1100, or 3105 to ASTM B209 with H-14 temper, minimum 0.4 mm thickness, with smooth mill finish.

.2 Vapor Barrier: Provide factory applied vapor barrier, consisting of kraft paper with 1 mil thick low density polyethylene film, heat and pressure bonded to inner surface of the aluminum jacketing.

.3 Fitting Covers: Material as for aluminum roll jacketing, pre-molded, one or two piece covers, which includes elbows, tee/valves, end caps, mechanical line couplings, specialty fittings, etc.

.4 Manufacturers:

.1 RPR Products; Insul-Mate.

.2 Childers.

.3 Pabco.

.4 Or approved equal in accordance with B7.

.4 Type 4 – Buried for Type 3 Insulation:

.1 Jacket system to be foam glass manufacturer's standard Pittwrap bituminous resin with woven, glass fabric, aluminum foil layer, and plastic film coating, heat-sealed at overlap.

Part 3 Execution

3.1 APPLICATION

.1 General:

.1 Insulate valve bodies, flanges, and pipe couplings.

.2 Insulate and vapor seal hangers, supports, anchors, and other piping appurtenances that are secured directly to cold surfaces.

.3 Do not insulate flexible pipe couplings and expansion joints unless they are located outdoors.

.4 Service and Insulation Thickness: Refer to Insulation Schedule below and to Process Piping Schedule in Section 40 27 00, Process Piping – General.

.5

Insulation Schedule

Service Type	Pipe Legend	Thickness	Fluid Temperature (degrees C)*	Insulation	Finish Systems			
					Concealed from View	Indoors Exposed	Outdoors	Buried
Air Low Pressure	ALP	50 mm noise insulation	- 25 to 120	Type 5	Type F3	Type F3	Type F3	N/A
Foul Air (outdoors only)	FOA	50 mm noise insulation	- 25 to 40	Type 5	Type F3	N/A	Type F3	N/A
Flushing Service Water (outdoors only)	FSW	40 mm (up to 100 mm pipe) 50 mm (above 100 mm pipe)	0 to 25	Type 1	Type F3	N/A	Type F3	N/A
Ferric Chloride (outdoors only)	FC	40 mm	0 to 25	Type 1	Type F3	N/A	Type F3	N/A
Scum (buried outdoors only)	SC	75 mm	1 to 25	Type 3	N/A	N/A	N/A	Type 4
Mixed Polymer (buried outdoors only)	MP	75 mm	1 to 25	Type 3	N/A	N/A	N/A	Type 4
Sodium Bisulphite	SBS	25 mm	5 to 25	Type 1	Type F1	Type F1	Type F3	N/A
Sodium Bisulphite	SBS	25 mm	5 to 25	Type 3 (to 300 mm above grade)	N/A	N/A	N/A	Type F4
Sodium Hypochlorite	SHC	25 mm	5 to 25	Type 1	Type F1	Type F1	N/A	N/A
Sodium Hydroxide (heat traced)	SHD	25 mm	15 to 25	Type 1	Type F1	Type F1	N/A	N/A
Heating Systems	HWR, HWS, GS, GR	40 mm (up to 100 mm pipe) 50 mm (above 100 mm pipe)	21 to 121	Type 2	N/A	F1	F3	N/A

Insulation Schedule

Service Type	Pipe Legend	Thickness	Fluid Temperature (degrees C)*	Insulation	Finish Systems			
					Concealed from View	Indoors Exposed	Outdoors	Buried
Diesel Fuel Supply (outdoors only, heat traced)	DFS	25mm	5 to 15	Type 1	Type F3	N/A	F3	N/A
Potable Water and Domestic Hot Water Systems, Non potable Water	PW, DHW, NPW	25 mm	4 to 60	Type 1	N/A	F1	F3	N/A
Cooling Systems (Condensate chilled water, and refrigerant)	CON, RWL, CWS, CWR, R, CHS, CHR	20 mm (Condensate) 20 mm (Refrigerant) 25 mm (Roof Drain) 40 mm CWS, CWR, CHS, CHR (up to 100 mm pipe) 50 mm CWS, CWR, CHS, CHR (above 100 mm pipe)	4 to 15	Type 1	N/A	F1	F3	N/A
HT-Piping requiring heat tracing	D	Pipe Size: Insulation Thickness Inches: [a b] 25 mm (pipe up to 75 mm) 40 mm (pipe from 100 mm to 250 mm)	10 to 40	All Outdoors: Type 1 Insulate and heat trace outside lines 1' above grade. Use Type 3 insulation from 1' above grade to frost depth	N/A	N/A	F3	F4 on Type 3

*Use these fluid temperatures unless otherwise noted in the Process Piping Schedule.
[a]Based upon insulation with glass fiber per ASTM C547, outdoors with 9 L/s wind with 10% safety and no value assigned to cladding or air space at cladding.
[b]Matches the watts per meter in Section 40 41 13, Pipe Heat Tracing

3.2 INSTALLATION

.1 General:

.1 Install in accordance with manufacturer's instructions and as specified herein.

.2 Install insulation after piping system has been pressure tested and leaks corrected.

.3 Apply insulation over clean finish painted and dry surfaces.

.4 Do not allow insulation to cover nameplates or code inspection stamps.

.5 Run insulation continuously through pipe hangers and supports, wall openings, ceiling openings, and pipe sleeves, unless otherwise shown.

.6 Install removable insulation sections on devices that require access for maintenance of equipment or removal, such as unions and strainer end plates.

.7 Use insulating cements, lagging adhesives, and weatherproof mastics recommended by insulation manufacturer.

.2 Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces of scraps abutting each other.

.3 Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Seal open ends of insulation with mastic. Sectionally seal all

butt ends of chilled water and condensate drain piping insulation at fittings with white vapor barrier coating.

.4 Cover valves, flanges, fittings, and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job-fabricated units. Finish cold pipe fittings with white vapor barrier coating and hot piping with white vinyl acrylic mastic, both reinforced with glass cloth.

.5 Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.

.6 Install protective metal shields and foamglass inserts where pipe hangers bear on outside of insulation.

.7 Insulation on piping that is to be heat traced shall be installed after installation of heat tape.

.8 Insulate valve bodies, flanges, and pipe couplings.

.9 Insulate and vapor seal hangers, supports, anchors, and other piping appurtenances that are secured directly to cold surfaces.

.10 Do not insulate flexible pipe couplings and expansion joints.

.11 Connection to Existing Piping: Cut back existing insulation to remove portion damaged by piping revisions. Install new insulation.

.12 Cold Surfaces: Provide continuous vapor seal on insulation on cold surfaces where vapor barrier jackets are used.

.13 Placement:

- .1 Slip insulation on pipe or tubing before assembly, when practical, to avoid longitudinal seams.
- .2 Insulate valves and fittings with sleeved or cut pieces of same material.
- .3 Seal and tape joints.

.14 Insulation at Hangers and Supports: Install under piping, centered at each hanger or support.

.15 Heat Traced Piping: Apply insulation after heat-tracing work is completed and approved.

.16 Vapor Barrier:

- .1 Provide continuous vapor barrier at joints between rigid insulation and pipe insulation.
- .2 Install vapor barrier jackets with pipe hangers and supports outside jacket.
- .3 Do not use staples and screws to secure vapor sealed system components.

.17 Aluminum Jacket:

- .1 Use continuous friction type joint to hold jacket in place, providing positive weatherproof seal over entire length of jacket.

.2 Secure circumferential joints with preformed snap straps containing weatherproof sealant.

.3 On exterior piping, apply coating over insulation and vapor barrier to prevent damage when aluminum fitting covers are installed.

.4 Do not use screws or rivets to fasten the fitting covers.

.5 Install removable prefabricated aluminum covers on exterior flanges and unions.

.6 Caulk and seal all exterior joints to make watertight.

.18 PVC Jacketing:

.1 Overlap jacketing minimum 50 mm. Seal and band longitudinal and circumferential joints and seams with sealing compound and pre-formed aluminum or stainless steel straps and fasteners.

.2 Make special provision, according to manufacturer's instructions, to allow uniform expansion on jacket to avoid joint opening on piping with 50 mm or greater layer of insulation.

.3 Provide removable sections at inspection openings, arranged to allow removal and replacement without cutting cover or retaining system.

.4 Design covers for flanges, fittings and expansion pieces with hinged locking arrangement to allow removal and replacement without cutting cover or retaining system.

3.3 FIELD FINISHING

.1 Apply coating of insulating cement where needed to obtain smooth and continuous appearance.

.2 Where pipe labels or banding are specified for a piping system they shall be applied to the finished insulation and not to the pipe.

.3 Painting Piping Insulation (Exposed to View):

.1 Metal or PVC jacketing does not require painting.

.2 If an insulated piping system is indicated to be painted in Section 40 27 00, Process Piping—General, the piping shall receive the following:

.1 Prime coat in accordance with Section 09 90 00, Painting and Coating.

.2 Finished insulation (and not the piping) shall be painted in accordance with Section 09 90 00, Painting and Coating.

END OF SECTION

Part 1 General

1.1 DESIGN REQUIREMENTS

.1 Develop a demonstration and test procedure, along with test forms, for the FAT.

1.2 SUBMITTALS

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

.2 Submit the following for review at least 31 Calendar Days prior to FAT.

.1 Detailed test procedure and test forms for review.

.1 Incorporate all changes to the procedure and test forms requested by the Contract Administrator.

.3 Submit the following, to be received on the date of the FAT:

.1 Detailed listings of all control logic and software utilized to implement the control sequences, for the scenarios demonstrated as part of the FAT. Listings are to be neatly organized and commented as required. All supporting documents, including variable listings, are to be included.

.4 Submittal of the test results for review and acceptance.

1.3 CLOSEOUT SUBMITTALS

.1 Include all FAT documentation and test forms in the operating and maintenance manuals in accordance with Section 01 78 00 – Closeout Submittals.

1.4 DEMONSTRATION AND TESTING

.1 The location of the FAT will be in a Contractor supplied facility, within Winnipeg, Manitoba, Canada.

.2 Correct deficiencies and re-test until satisfactory performance is obtained.

.3 Acceptance of tests during the FAT will not relieve the Contractor from responsibility for ensuring that complete systems meet every requirement of the Contract.

1.5 COMPLETION OF FAT

.1 The FAT is considered to be complete only when full approval of the Contract Administrator has been received by the Contractor.

.2 Schedule additional re-tests until approval is obtained.

Part 2 Products

2.1 NONE USED.

.1 None Used.

Part 3 Execution

3.1 PROCEDURES

.1 All tests shall be documented.

.2 Produce test forms to allow for recording the results of the simulations and tests.

.3 Propose the desired date of the FAT to the Contract Administrator with at least seven (7) calendar days advanced notice. The Contract Administrator may, at their discretion, observe FAT based on the completeness of the submittal or other factors.

.1 Demonstration tests to include:

.1 Scope of the test, including hardware, software, programming, configuration, documentation etc.

.2 Hardware, including construction, visual inspection, wiring, labeling, agreement with Shop Drawing, requirements and acceptance criteria.

.3 Complete demonstration that the PLC program meets the requirements of the Electric and Electronic Control System For HVAC document described in Section 23 09 33 – Electric and Electronic Control System for HVAC and the Process Control Narratives of each station.

.4 Test each I/O point from the terminal block to the PLC system.

.5 Testing of all status and alarm signals. Alarm assignments: Type, value, priority, etc shall be checked.

.6 Controller processor spare capacity.

.7 System programming and configuration capability.

.4 The Contract Administrator may request additional tests and simulations at the FAT.

.5 The Contract Administrator will review the system, simulations, and test results. Incorporate comments and feedback from the Contract Administrator into the system design.

3.2 Evaluation

.1 All evaluations will be pass/fail.

.2 The Contractor is expected to ensure that all required demonstrations are fully operable and meet required specifications, prior to the FAT. Upon failure of a required demonstration in the FAT, the Contractor shall provide subsequent re-tests to the satisfaction of the Contract Administrator.

.3 Acceptance of the FAT results by Contract Administrator is required prior to the shipment to site.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Submit commissioning test plans, procedures and commissioning forms, in writing, at least 31 Calendar Days prior to commissioning.

.3 Submit Final Automation Commissioning Report as described in Part 1.5 of this specification.

1.2 COMMISSIONING FORMS

.1 Contractor is responsible for calibrating all instrumentation devices prior to commissioning. Sample commissioning forms will be provided with the tender. The Contractor is responsible for providing all required testing and commissioning forms including checklists, forms, and reports as necessary. Microsoft Word versions of the sample commissioning forms can be provided after contract award.

.2 Supplement the provided forms as required to make a complete commissioning report package.

1.3 COMMISSIONING

.1 Carry out commissioning under direction of the Contract Administrator and in the presence of representatives of the Contract Administrator and the City.

.2 Inform and obtain approval from the Contract Administrator in writing at least 14 Calendar Days prior to commissioning or each test. Indicate:

- .1 Location and part of system to be tested or commissioned.
- .2 Testing/commissioning procedures and anticipated results.
- .3 Names of testing/commissioning personnel.
- .4 City personnel requirements to assist with commissioning.

.3 Correct deficiencies and re-test until satisfactory performance is obtained.

.4 Acceptance of tests will not relieve the Contractor from their responsibility of ensuring that complete systems meet every requirement of the Contract.

.5 Contractor is responsible for the creation of the Local Control Panel HMI screens for MacLean, Hurst, and McPhillips Pumping Station associated with this project. Contractor will carry out commissioning in order verify HMI function as intended. Refer to City of Winnipeg -Water & Waste Department – HMI Layout and Animation Plan for HMI requirements.

.6 Perform tests as required.

1.4 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

1.5 CLOSEOUT SUBMITTALS

.1 Submit to the Contract Administrator the Final Automation Commissioning Report in accordance with the requirements of Section 01 78 00 – Closeout Submittals.

.2 The Final Automation Commissioning Report to:

.1 Include measurements, final settings, and certified test results.

.2 Include completed commissioning forms.

.3 Bear signature of the commissioning technician and supervisor.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments, and modifications as set during commissioning.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions, or energy consumption.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system.

.2 Provide two-way radios for communication between field technicians.

.3 Test instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.4 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 6 months prior to tests.

Part 3 Execution

3.1 STATUS PRIOR TO COMMISIONING

.1 Prior to commissioning, ensure that the following is completed:

.1 Installation of all panels and completion of all wiring connections.

.2 Testing wiring for continuity from the field device to the control panel.

.2 Provide a minimum of one qualified technician to test and commission the control system.

3.2 PROCEDURES

.1 Scope of the test includes hardware, software, programming, configuration, documentation etc.

.2 Hardware, includes construction, visual inspection, wiring, labeling, agreement with Shop Drawing, requirements and acceptance criteria,

.3 Test each I/O point from the instrument to the PLC system.

.1 Test both states of discrete points.

.2 Test, at minimum, two values for analog points.

.3 Test communications of the PLC with the City's SCADA systems.

.4 Test each piece of equipment individually for complete functionality.

.5 All modifications to the software program, to bypass interlocks or sensors, shall be recorded and documented clearly in a separate document, and in the software.

.1 Any software bypasses that remain, prior to leaving the Site, must be authorized by the Contract Administrator or designated representative.

.6 All deficiencies must be corrected by the Contractor.

.7 Commission each system using procedures prescribed by the Contractor Administrator.

.8 Optimize operation and performance of systems by fine-tuning control loops and PID values

.9 The Contractor is responsible for the commissioning of the Local HMI Screens associated with the Work. HMI screen commissioning shall confirm, not limited to the following,

.1 Equipment status

.2 Equipment alarms

.3 Equipment control

3.3 SYSTEM SOFTWARE

.1 Load PLC system with appropriate program, fully tested and approved as part of the software FAT.

.1 Any changes made to the software after the FAT must be submitted for review and approval of the Contract Administrator.

.2 Any issues identified on Site must be communicated to the Contract Administrator. Approval is required prior to making any modifications.

.3 The Contractor is reminded that this facility is critical to operation of the City's water distribution system

3.4 CHECKLISTS, FORMS, AND REPORTS

.1 Complete commissioning forms including checklists, forms, and reports for each instrument, loop, and control device.

.1 Instrument Loop Checklist.

.2 Discrete I/O Checklist

.3 Analog I/O Checklist

.4 Panel Hardware/ Software Checklist

3.5 DEMONSTRATION

.1 Demonstrate to the Contract Administrator operation of systems including sequence of operations under all potential conditions, start-up, shut-down interlocks and lock-outs.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Process and HVAC instrumentation.

1.2 REFERENCES

.1 National Electrical Manufacturers Association (NEMA).

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Submit Shop Drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in operation and maintenance manuals in accordance with Section 01 78 00 – Closeout Submittals.

.3 Submit documentation as described in Section 40 80 11 - Automation Commissioning for devices listed within this section.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant.

.3 Operating conditions: 0 – 35 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.

.4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.5 Contractor is responsible to field calibrate all measuring devices and set the 4-20mA range as indicated on Drawings. Contractor to verify all desired 4-20mA output range with Contract Administrator prior to calibration. Contractor shall confirm devices are reading correctly on City SCADA HMI screen.

2.2 INDOOR TEMPERATURE ELEMENT AND TRANSMITTER (Wall mount)

.1 Requirements:

.1 Sensor:

.1 3- wire RTD, Pt100.

.2 Probe length 120mm.

.3 Probe diameter 6.25mm.

.4 Measurement range: -200 to 850 degree Celsius.

.5 Protective sheath for external mounting.

.2 Transmitter:

.1 Output signal: 4-20mA 2 wire with connection to HART.

.2 Accuracy: +/- 0.06 Degree Celsius.

.3 Enclosure:

.1 Transmitter is housed in a NEMA4X wall mount electrical enclosure with temperature element mounted externally.

.4 Operating Ambient Conditions:

.1 -40 to 85 degree Celsius, 98% relative humidity with condensation.

.5 Approvals: CSA or equivalent.

.2 Acceptable Products:

.1 Siemens SITRANS

.2 Or approved equal in accordance with B7.

2.3 HVAC TEMPERATURE SWITCHES

.1 Requirements:

.1 Functionality: Field adjustable with reference dials for each pole.

.2 Output: Qty 2, individually adjustable, DPDT dry contacts.

.3 Operating Temperature: -20 to 40 degree Celsius minimum.

.4 Sensor: Local.

.5 Mounting: Duct.

.6 Enclosure Rating: NEMA Type 4X.

.7 Approvals: CSA or equivalent.

.2 Acceptable Products:

.1 Ashcroft B-Series,

.2 United Electric B402-120,

.3 Or approved equal in accordance with B7.

2.4 HVAC FILTER DIFFERENTIAL PRESSURE SWITCHES

.1 Requirements:

.1 Type: Electro-mechanical.

.2 Dry Contact: SPDT, rated for at least 0.2 Amps at 24VDC.

.3 Operating Temperature: 0°C to 35°C.
.4 Set Point: 125 Pa (0.5 "w.c), Field adjustable.
.5 Pressure Range: As Required.
.6 Enclosure Rating: NEMA 4X.
.7 Approvals: CSA or equivalent.
.8 Mounting: Surface, Duct or Wall.

.2 Acceptable Products:

.1 Ashcroft B-Series,
.2 United Electric 100 Series,
.3 Or approved equal in accordance with B7.

2.5 GAS MONITOR

.1 Requirements:

.1 Operating Voltage: 24 VDC.
.2 Gas Sensor Requirement: Chlorine.
.3 Chlorine detection.
.4 Graphical LCD Display.
.5 Remote sensor installation.
.6 Three form C relays.
.7 Controller fault detection available.
.8 City of Winnipeg Approved.
.9 Operating Ambient Conditions:
  .1 -40 to 75 degrees Celsius.
  .2 5 to 95% relative humidity, non-condensing.
.10 NEMA 4x Rated.
.11 Electrical Signal: 2 wire, 4-20 mA.
.12 Auto Test feature consisting of an electromechanical gas generator which plugs into location within sensor holder and automatically generates a small concentration periodically to verify sensor operation.
.13 Gas Range: 0-5ppm

.2 Acceptable Products

.1 ATI D12.
.2 Or approved equal in accordance with B7.

2.6 GAS MONITOR DUAL HORN/STROBES AND STROBES

.1 Requirements:

.1 Operating Voltage: 120 VAC.
.2 NEMA 4X compliant
.3 Lighting Type: LED
.4 LED Color: Red

.5 CSA or cUL rated.

.6 Temperature Range : -55 Degrees to 70 degrees Celsius.

.7 Provide dual horn/strobe or strobe unit as indicated on drawings. Provide dual mounting kit for horn/strobe unit.

.2 Acceptable Products

.1 Federal Signal Global Series Hazardous Signal Dual Signal (G-STR and G-SND)

.2 Or approved equal in accordance with B7

2.7 ULTRA LOW PRESSURE DIFFERENTIAL PRESSURE TRANSDUCER

.1 Requirements

.1	Approvals:	CSA or equivalent
.2	Sensing range:	-124.6 Pa (0.5 “w.c.) – 124.6 Pa (0.5 “w.c.)
.3	Sensor Body:	Titanium or Stainless Steel
.4	Pressure Connection:	¼ NPT
.5	Electrical Connection:	Screw terminal
.6	Electrical Signal:	2 wire, 4-20 mA,
.7	Accuracy:	<±0.5% of span
.8	Rating:	NEMA 4X

.2 Acceptable Products

.1 Ashcroft IXLdp (has FM approval which meets City standards)

.2 Or approved equal in accordance with B7.

2.8 FLOW ELEMENT AND SWITCH

A. Flow Switch,
1. General:
   a. Approvals: CSA or cUL
   b. Function: Monitor air flow and provide contact closure at set point. Utilized to confirm associated HVAC unit is running.
   c. Indoor located flow switch suitable for NEMA 4X
   d. Outdoor located flow switch to be outdoor rated.
   e. Indoor unit suitable for corrosive environment.
   f. Flow switch suitable for operating in air ducts.
2. Service:
   a. Fluid: Supply and Exhaust Air.
   b. Operating characteristics: Operate between 200-5000cfm
   c. Operate in air ducts up to 500mmX500mm.
3. Performance:
   a. Set Point: Field adjustable.
   b. Repeatability: <1 percent at constant temperature
   c. Temperature, Operating: Sensor Element: Minus -40 to plus 75 degrees C.
4. Probe:
   a. Type: Suitable for use in large air ducts.

b. Insertion Element: Consult with manufacturer based on air duct dimension where flow switch is located. Choose appropriate length. Refer to drawings for air duct sizes and approximate flow switch locations.

5. Electronics:
   a. Location: Integral with element.
   b. Operating Temperature: Minus 40 to 50 degrees C.
6. Signal Interface:
   a. Contacts: SPDT at 115VAC
7. Enclosure:
   a. Type: NEMA 4X.
8. Power:
   a. No external power. Two wire system.
9. Manufacturer:
   a. Magnetrol
   b. Dwyer
   c. FCI (Fluid Components International)
   d. Or approved equal in accordance with B7

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment and components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturer’s recommended methods, procedures, and instructions.

.3 Support field-mounted panels, transmitters, and sensors on pipe stands or channel brackets.

.4 Electrical:

.1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install communication wiring in conduit or utilizing ACIC cabling if shown on the Drawings.

.1 Provide complete conduit /cable system to link instrumentation and the control panel(s).

.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.

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 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 or filter racks.

.4 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 the one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

3.3 IDENTIFICATION

.1 Identify field devices with lamacoids. Install in a conspicuous location.

3.4 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 40 80 11 - Automation Commissioning.

.2 It is the responsibility of the contractor to calibrate and commission all automation measuring devices to function as indicated in the specifications and drawings. The contractor is to work with the City and the Contract Administrator to commission the automation measurement devices to ensure their reading correctly at the HMI.

3.5 TRAINING

.1 Provide one 4-hour training session on complete operations and maintenance of the system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Primary control devices including damper actuators.

1.2 REFERENCES

.1 Association (NEMA).

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Submit Shop Drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in operating and maintenance manuals in accordance with Section 01 78 00 – Closeout Submittals.

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 assembly.

.3 Operating conditions: 0 to 32 degrees Celsius with 5 to 95% 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 portable two-way radios.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 ELECTRONIC MODULATING DAMPER ACTUATORS

.1 Requirements:

.1 General:

.1 Drawings, control diagrams, and schedules indicate estimated quantities of actuators for each motorized damper.

.2 Select actual quantity of actuators required to operate each damper in accordance with size of damper provided.

.3 Coordinate exact quantity of actuators with electrical work to ensure that necessary wiring and conduit is provided for installation.

.4 Equip modulating damper actuators with spring return fail safe function.

.2 CSA or cUL approved.

.3 Operating voltage: 120 VAC.

.4 Provide a 4-20 mA position signal for each modulating damper.

.5 Provide a 4-20 mA position feedback signal for each modulating damper.

.6 Ambient operating temperature -40 to 50 degree Celsius.

.2 Acceptable manufacturer:

.1 Schischek by Rotork Controls (Canada) Ltd., InMax,

.2 Or approved equal in accordance with B7.

2.3 ELECTRONIC ON-OFF DAMPER ACTUATORS

.1 Requirements:

.1 General:

.1 Drawings, Control Diagrams and schedules indicate estimated quantities of actuators for each motorized damper.

.2 Select actual quantity of actuators required to operate each damper in accordance with size of damper provided.

.3 Coordinate exact quantity of actuators with electrical work to ensure that necessary wiring and conduit is provided for installation.

.4 Equip on-off damper actuators with spring return fail safe function. Damper shall not require separate input signals for opening and closing actuators.

.2 CSA or cUL approved,

.3 Operating voltage: 120 VAC,

.4 Provide two auxiliary end-switch contacts, one for fully open and one for fully close, for each on/off damper.

.5 Ambient operating temperature -40 to +50 degree Celsius.

.6 Actuator shall be equipped with heater.

.7 Actuator to be equipped with weatherproof housing for outdoor installation.

.2 Acceptable manufacturer:

.1 Schischek by Rotork Controls (Canada) Ltd., InMax,

.2 Or approved equal in accordance with B7.

2.4 WALL HEATERS IN VESTIBULES

.1 Temperature controlled by wall mounted thermostat provided by unit heater manufacturer.

2.5 AIR HANDLING UNITS

.1 Temperature controller by remote thermostat provided by air handling unit manufacturer.

.2 Run command controlled by PLC based on occupancy status and chlorine leak

.3 Speed controlled by PLC based on occupancy status and chlorine leak.

2.6 ELECTRIC DUCT HEATER

.1 Temperature controller by temperature sensor and controller provided by duct heater manufacturer.

.2 Duct heater enabled by PLC based on outdoor temperature.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment and components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturer’s recommended methods, procedures, and instructions.

.3 Dampers mounted outdoors shall be protected from direct sun exposure, rain and snow.

.4 Support field-mounted panels, transmitters, and sensors on pipe stands or channel brackets.

.5 Electrical:

.1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install communication and control wiring in conduit. Utilize armored cabling only when run on cable tray.

.1 Provide complete conduit /cable system to link instrumentation and the control panel(s).

.2 Provide complete cable tray system for armored cabling.

.3 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.4 Maximum conduit fill not to exceed 40%.

.5 Design Drawings do not show conduit layouts or cable tray layouts. Provide as required, to suit the space.

.6 Terminate devices with leads in junction boxes with terminals.

.1 Wire nuts are not permitted.

.2 Protect leads in flexible conduit.

3.2 IDENTIFICATION

.1 Identify all instruments, control panels, and PLC panels with hard plastic lamacoid nameplates. Mount in a manner so that the tags are visible. Refer to Section 40 05 01 – Common Work Results – Automation.

3.3 TESTING AND COMMISSIONING

.1 Calibrate and test control devices for accuracy and performance in accordance with Section 40 80 11 – Automation Commissioning.

3.4 TRAINING

.1 Provide one 4-hour training session on complete operations and maintenance of the system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International),

.1 C22.2 No.205-M1983(R2004), Signal Equipment.

.2 International Electrotechnical Commission (IEC),

.1 IEC 61131, Programmable Controllers.

.3 City of Winnipeg Design Standards,

.1 Tag Naming Standard, 612620-0014-40ER-0001 Rev. 00.

1.2 DEFINITIONS

.1 **"PLC"** means Programmable Logic Controller

.2 **"FAT"** means Factory Acceptance Testing. All FAT type testing to be performed at the equipment vendor facilities, utilizing the equipment vendor's labor, materials and test equipment

.3 **"I/O"** means Input/Output

1.3 SOFTWARE OWNERSHIP

.1 The City will fully own all PLC programming logic supplied and may utilize the software provided for any purpose including:

.1 Modification and revision.

.2 Use at other City facilities.

.2 The City may turn the software over to a 3rd party, for use at any City owned facility.

.3 Provide source code for all custom software and function blocks or any other software logic utilized in the application.

.1 Source code for base function blocks provided by the PLC manufacturer are not required.

1.4 DESIGN REQUIREMENTS

.1 Design, program, and implement a complete operating HVAC PLC control system.

.2 Provide a functional requirement description document of the HVAC PLC control system.

.3 The Contractor's HVAC PLC program design is to be based upon the hardware design Drawings, Section 23 09 33 – Electric and Electronic Control System for HVAC, and the HVAC equipment manufacturer's control recommendations.

.1 Utilize a tag naming convention that extends and does not conflict with the tag scheme utilized on site.

.2 Utilize the City of Winnipeg Identification Standard (Rev. 4 Updated 2019-02-08) within the functional requirements document and HVAC PLC program.

.4 Input conditioning to map inputs from physical inputs and networked devices to internal HVAC PLC tags.

.5 Output conditioning to map internal HVAC PLC tags to physical outputs and networked devices.

.6 The PLC software design is to be supervised and authenticated (sealed) by a professional engineer licensed to practice in Manitoba.

.7 Do not assume that the Contractor's internal standards or standard programming methodology will be acceptable for this project. No additional payment will be made for assumptions made regarding standard methods utilized by the Contractor.

.8 The Contract Administrator will review the overall design. Make changes as requested by the Contract Administrator.

1.5 SUBMITTALS

.1 All submittals to be in accordance with Section 01 33 00 – Submittal Procedures.

.2 Stage 1:

.1 Submit product datasheets and PLC panel hardware shop drawings.

.3 Stage 2:

.1 Submit a draft functional requirement document prior to initiating programming which includes:

.1 The general PLC program structure.

.2 The programming languages (must be functional block diagram as per City standard)

.3 A sample section of code.

.4 HMI interface.

.5 SCADA interface map.

.6 Variable naming methodology.

.4 Stage 3:

.1 Submit a 25% complete functional requirement document submittal, including:

.1 Software logic printout.

.2 The primary purpose of this submittal is to ensure that the methodology being utilized is as per requirements prior to the bulk portion of the Work being completed. At this point, copies of code for similar pieces of equipment should not be completed.

.5 Stage 4:

.1 Submit a 99% complete functional requirement document submittal a minimum of 31 Calendar Days prior to the FAT, including:

.1 Complete software logic printout.

.6 Submit operation and maintenance manuals as described in Part 1.6 of this Specification.

.7 Submit spare parts as described in Part 2.4 of this Specification and in accordance with 01 78 00 – Closeout Submittals.

1.6 OPERATION AND MAINTENANCE MANUALS

.1 Operation and maintenance manuals to be submitted in accordance with Section 01 78 00 – Closeout Submittals.

.2 Include the following in the operation and maintenance manuals:

.1 Product datasheets.

.2 Hardware and software user manuals.

.3 PLC logic printout.

.4 Flash drive sleeve with USB memory stick containing PLC application program.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLER/REMOTE I/O MODULE

.1 Part or Model numbers for PLC Controllers shall be as shown on Maclean control panel Drawings. (refer to Drawings 1-0630M-A0053-002).

.2 Part or Model numbers of remote I/O rack in HVAC control panels at shall be as shown on Mcphillips control panel Drawing. (refer to Drawing 1-0640C-A0003). The PLC controller is existing and located in CP-M826 in the main pumphouse Mechanical Room. Refer to Drawing 1-0640M-A0050-002 for new equipment in CP-M826.

.3 Part or Model numbers of remote I/O rack in existing HVAC control panels at shall be as shown Hurst Stations control panel Drawings. (refer to Drawings 1-0650M-A0060). The PLC controller is existing and located in CP-M806 in the Main Pumphouse Control Room. Refer to Drawing 1-0650M-A0040-001 for new equipment in CP-M806.

.4 Provide all required hardware for a complete installation.

2.2 HUMAN MACHINE INTERFACE (HMI)

.1 Part or Model number shall be as shown on the control panel Drawing for Maclean Pumping Station. (refer to Drawing 1-0630M-A0053-002)

.2 No HMI screen will be located on new Remote I/O panel CP-C827 at McPhillips Pumping Station. The new HMI screens to be completed by the contractor associated with the chlorine building HVAC upgrades will be added to the existing HMI screen at CP-M827 in the Main Pumphouse Mechanical Room.

.3 No HMI screen will be located on new Remote I/O panel CP-C827 at Hurst Pumping Station. The new HMI screens be completed by the contractor associated with the

chlorine building HVAC upgrades will added be to the existing HMI screen at CP-M806 in the Main Pumphouse Control Room.

.4 Provide all required hardware for a complete installation.

2.3 ACCESSORIES

.1 Include the following accessories:

.1 One flash card, installed in the PLC processor, for running the application program.

.2 One spare flash card of the same size and configuration as that utilized in the processor.

.3 Serial or USB transfer cable for downloading the application program.

2.4 USB MEMORY STICK

.1 Provide a USB memory stick as part of the commissioning process, with the following:

.1 Latest application program, with documentation.

.2 PLC hardware user manuals

.3 PLC software user manuals.

.2 Locate the memory stick in a pocket in the control panel.

2.5 SPARE PARTS

.1 Supply the following spare parts for MacLean Pumping Station (refer to Drawing 1-0630M-A0053 for model numbers):

.1 One power supply module.

.2 One processor module.

.3 One DI 24 VDC I/O module.

.4 One DO 24 VDC I/O module.

.5 One AI module.

.6 One AO module.

.2 Supply the following spare parts for McPhillips Pumping Station (1-0640M-A0050 and 1-0640C-A0003 for model numbers):

.1 One power supply module.

.2 One ethernet remote I/O drop adaptor.

.3 One fiber converter module.

.4 One DI 24 VDC I/O module.

.5 One DO 24 VDC I/O module.

.6 One AI module.

.7 One AO module.

.3 Supply the following spare parts for Hurst Pumping Station (refer to Drawings 1-0650M-1-0650M-A0060 and 1-0650M-A0040 for model numbers):

.1 One power supply module.
.2 One ethernet remote I/O drop adaptor.
.3 One fiber converter module.
.4 One DI 24 VDC I/O module.
.5 One DO 24 VDC I/O module.
.6 One AI module.
.7 One AO module.

.4 Complete set of spare parts to be supplied prior to commissioning.

Part 3 Execution

3.1 HARDWARE INSTALLATION

.1 Update the processor and all updatable modules with the latest firmware before the FAT. Any latter firmware update requires a rechecking plan to be provided by the Contractor and approved by the Contract Administrator. The application rechecking plan should include a recheck of any part of the application software impacted by the firmware changes.

.2 The Contractor shall inform the Contract Administrator of any new firmware or software updates issued by the manufacturer after FAT. The Contractor shall inform the Contract Administrator if the installation of the new firmware or software update is required.

.3 Application rechecking due to firmware or software updates shall be performed at no additional cost.

.4 The Contractor to program the HVAC PLC and the panel HMI at Maclean Pumping Stations. The Contractor to make the programming updates to the existing PLCs at McPhillips and Hurst Pumping Station related to the upgrades associated with the Work and the additional HMI screens on the existing HVAC PLC panel HMI.

.5 The contractor to create HMI screens based on the HVAC P&IDs layouts provided in the drawing package.

.6 City will provide and implement SCADA HMI Modification.

Following is required for The City to complete the SCADA HMI modification:

.1 A minimum of 3 weeks advance notice that HMI modification will be required.
.2 Contractor to provide I/O list (with Modbus addresses), control narrative and description of what is to be displayed.

3.2 PLC PROGRAMMING SERVICES

.1 General Requirements:

.1 Program in a manner to make the program easy to follow and maintain.

.2 Programming language shall be functional block diagram. No ladder logic or structural text.

.3 Insert comments into the program to clarify all items not readily apparent.

.4 Utilize commonly accepted good programming practices.

.5 Utilize function blocks to encapsulate common systems and sections of code.

.6 All field inputs to be checked against range limits. If a field input is outside of its range limits or the data cannot be otherwise propagated because of an equipment fault, the data is to be declared "bad" within the control system.

.7 All tag names are to be named and identified using positive logic. Where required, provide comments to clarify the states.

.8 Program PID control loops to provide bumpless transfer when switching between automatic and manual control modes.

.9 Configure alarms generated in the HVAC PLC into two types:

.1 Automatic reset alarms clear upon the alarm condition being removed. Provide logic as required to ensure that fast cycling of the alarm does not occur.

.2 Manual reset alarms require reset from the HMI. Utilize manual reset alarms where the initiating condition would be removed by the action resulting from the alarm. Ensure that manual reset alarms are configured such that a reset signal from the HMI will not clear the alarm unless the initiating condition is cleared.

.10 For any piece of equipment that has control from the HVAC PLC, provide a manual and auto control mode selector buttons on the equipment faceplate and allow for manual control of the equipment from the HMI. Provision of a hardwired local, hand, or manual control mode in the field does not eliminate this requirement.

.11 Avoid creating unnecessary tags and variables. Any unused and/or obsolete and/or non-functional tags, logic, logic sections, etc. to be removed and purged from the final version of the program.

.12 Purge and pack memory periodically to reduce memory fragmentation.

.2 Provide all required HVAC PLC programming.

3.3 PLC COMMISSIONING SERVICES

.1 Provide all required HVAC PLC commissioning services as per Section 40 80 11 – Automation Commissioning.

.2 Upon completion of commissioning, load latest software onto spare card in spare processor. Test spare card prior to turning over to the City.

3.4 TRAINING

.1 Provide one 4-hour on-site training sessions by the equipment vendor or manufacturer to train operational and maintenance personnel in the use and maintenance of the system.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 All control panels shall be built by a CSA/cUL-approved manufacturer and shall bear the CSA/cUL seal with the manufacturer's file number.

.2 All control panels shall be factory assembled and pre-wired. The control panel wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

.3 Supply, install, wire, and test all components inside the control panels according to the Specifications herein and the Drawings.

1.2 SUBMITTALS

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

.2 Prior to construction:

.1 Submit product datasheets for review and approval of the Contract Administrator prior to construction of the control panels.

.2 Field mounted motor starter panels to be designed by the contractor based on motor starter schematic and connection drawings. Submit proposed panel layout drawings for approval to Contract Administrator prior to construction. Refer to requirements in this specification for control panel equipment.

.3 For control panel layout drawings provided as part of package, submit stamped red-line mark-ups of the Tender Drawing showing proposed modifications/deviations to Contract Administrator for approval during shop drawing review stage. If significant modifications are proposed/required, the sealed Tender Drawings (included in this package) in AutoCAD format will be supplied to the Contractor for revision and reference.

.3 Prior to shipment:

.1 Submit electronic pictures of enclosure exterior and interior, including door interior.

.1 Pictures to be of sufficient resolution to read component labels.

.2 As-built drawings:

.1 Submit as-built drawings. Minor changes may be made via red-line mark-ups.

.2 Draft significant changes on AutoCAD drawings.

.3 Submit panel FAT report to Contract Administrator for review.

.4 Do not ship control panel until approval from the Contract Administrator is received.

.4 Provide spare parts as described in Part 3.5 and in accordance with 01 78 00 – Closeout Submittals.

1.3 INSPECTION

.1 A factory inspection of the control panels will be performed at the discretion of the Contract Administrator based upon the pre-shipment submittals.

.2 If requested, demonstrate and test the control panel in the presence of the Contract Administrator's designated representative.

Part 2 Products

2.1 GENERAL

.1 Construct the control panels in accordance with the supplied Drawings. The construction drawing set includes some control panels with layouts provided. Control panels where panel layout drawings are provided, contractor shall provide red line markup of construction drawings indicating deviations from the construction drawings and shall receive approval from Contract Administrator before construction. In addition, there are 120V motor control panels that are the responsibility of the vendor to provide layouts based on the motor schematics included in the construction drawing set. Contractor to provide complete shop drawings of these control panels and shall receive approval from Contract Administrator prior to construction.

.2 Contractor shall provide vendor shop drawings for all fans motor starter panels. Shop drawings shall be approved by Contract Administrator prior to construction.

.3 Control devices of each category shall be of same type and manufacturer.

2.2 ENCLOSURES

.1 Install lamacoids as per the control panel layout Drawings. For control panels (i.e fan starter panels) where layout drawings are not created, provide lamacoid as indicated on general arrangement layout drawings and motor schematic drawings.

.2 All indoor control panels shall be NEMA 12 outside the chlorine area and NEMA 4X within the chlorine area (Chlorinator, Scale, and Tonner Areas) or as shown on Drawings. Exterior panels shall be NEMA 4X.

.3 Contractor is responsible to ensure control panel design fits in designated space indicated on layout drawings. Contractor shall take measurements on site and provide to vendor panel manufacturer prior to construction. Any spacing issues shall be notified to the Contract Administrator prior to construction.

.4 All enclosure angles and cut-outs shall be free of dents, gouges, or weld marks and shall present a clean, smooth appearance.

.5 No screws, fittings, or other fastenings shall be used on external panel faces, which must be free of any marks, scratches, or defaults.

.6 The door is to be a minimum 14 gauge steel plate, full height, and flush with adjacent surfaces.

.7 The exterior of the control panel shall be painted ANSI 61 grey.

.8 The interior of the control panel shall be painted gloss white.

.9 Component mounting plates shall be three (3) mm thick steel and shall be painted with one (1) coat of primer and one (1) coat of white baked enamel.

.10 All control panel doors shall be 900 mm (36 inches) wide maximum.

.11 All control panel doors shall open through 180 degrees without restriction.

.12 All control panels of a depth greater than or equal to 300 mm (12 inches) shall be equipped with a fluorescent lighting device located in the cabinet's upper portion with a door switch. Whenever the door is opened, the lighting system shall automatically be activated.

.13 Enclosure brand shall be Hoffman or approved equal in accordance with B7.

2.3 POWER SOURCE

.1 Each power source must be protected by a CSA approved circuit breaker or fuse.

.2 The location of each power source must be clearly shown.

.3 Panels powered by more than one (1) electrical source shall display on their door; "Caution: This panel is electrically powered by more than one source".

2.4 COMPONENTS

.1 Unless written approval for use of unapproved components is received from the Contract Administrator, all electrical materials (e.g., conduit, fittings, wireways, etc.) shall be CSA or cUL approved.

.2 Rails (DIN Rails)

.1 Rails used must be DIN Rail style TS 35mm, slotted.

.2 When used to mount terminals, rails shall be mounted on straight raisers (rail support / mounting feet) so as to raise them to the same height as the highest adjacent wiring duct.

.3 Raisers (rail support / mounting feet) shall not be used when rail hosts heavy components.

.3 Terminals

.1 Requirements:

.1 TS-35 DIN Rail mounting.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.3 Manufacturer: Phoenix Contact or approved equal in accordance with B7.

.2 Terminal blocks shall be designed for the size of the wires to be connected to them. Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.3 Each terminal shall bear an identification number on both sides.

.4 Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The Contractor must supply and install such components when required.

.4 Ground Bus Bar

.1 Supply a ground bus bar in each control panel.

.2 Requirements:

.1 Tapped holes with screws.

.2 Bar to have sufficient connection points for all cables entering the control panel, plus 25% spare.

.3 Maximum one wire termination per screw.

.5 Pushbutton, Switch, and Indicator Light

.1 When required, all control panel pushbuttons, switches, and indicator lights shall be at least NEMA 12 (or better)-type devices.

.2 Manufacturer to be Schneider Electric or approved equal in accordance with B7.

.6 Programmable Logic Controllers

.1 As per section 40 94 43- Programmable Logic Controller (PLCs).

.7 General Purpose Relays

.1 Type: DPDT or as shown on Drawings.

.2 Indication: LED.

.3 Coil voltage: As per Drawings.

.4 Contact rating: 5A (120 VAC), 5A (24 VDC).

.5 Provide diode suppression for DC coils.

.6 Socket mounting: 35mm DIN rail

.7 Approvals: CSA.

.8 Manufacturer: Omron, Finder or approved equal in accordance with B7.

.8 I/O Relays

.1 Relay interface for PLC Discrete Inputs, 1PDT :

.1 Coil rating: 3.5 mA at 120 VAC.

.2 Contact material: Gold-plated silver tin oxide alloy.

.3 Contact switching voltage: 36 V dc max.

.4 Contact minimum switching current: 1 mA.

.5 Contact maximum inrush current: 50 mA.

.6 Wire Size: 26 to 14 AWG for both input and output side.

.7 Color: Gray body.

.8 Width: 6.2 mm.

.9 Bridging: Plug-in bridge.

.10 Approvals: cULus

.11 Standard of acceptance: Phoenix Contact 2966281.

.2 Relay interface for PLC Discrete Outputs, 1PDT :

.1 Coil rating: 9 mA at 24V dc.

.2 Contact material: Silver tin oxide alloy.

.3 Contact switching voltage: 5V ac min, 250 V ac max.

.4 Contact limiting continuous current: 6A.

.5 Wire Size: 26 to 14 AWG for both input and output side.

.6 Color: Gray body.

.7 Width: 6.2 mm.

.8 Bridging: Plug-in bridge.

.9 Approvals: cULus

.10 Standard of acceptance: Phoenix Contact 2966171.

.9 24 VDC Uninterruptible Power Supplies

.1 Approvals: CSA.

.2 Input: 100-240 VAC, 45-65 Hz.

.3 Output: 24VDC.

.4 Mounting: NS 35 DIN rail.

.5 Capable of redundant operation with redundancy module.

.6 Performance:

.1 Load regulation: < 2%.

.2 Temperature derating: 2.5 %/ degree Celsius from 60 degree Celsius.

.3 Output ripple: < 20 mV

.4 Efficiency: 90% (120 VAC) and 96% (Battery operation).

.7 Features:

.1 Capable of parallel operation.

.2 Dynamic Boost 15A.

.3 Input transient surge protection.

.4 Protection Class I

.8 Status lights:

.1 DC OK LED.

.2 Alarm LED.

.3 BAT MODE.

.4 Ready.

.5 Remote.

.6 BAT-Start.

.9 Energy Storage, lead AGM, VRLA technology, 24 V DC, 3.4 Ah

.10 Environmental:

.1 Temperature, operating: -25 to 70 degree Celsius.

.2 Humidity, operating: max 93%, non-condensing.

.11 Manufacturer and series:

.1 Phoenix Contact, TRIO-UPS-2G/1AC/24DC/10,

.2 Phoenix Contact, UPS-BAT/VRLA/24DC/3.4AH,

.3 Or approved equal in accordance with B7.

.10 Grounding

.1 All control panel components shall be adequately grounded in accordance with the component manufacturer, especially control system components.

.2 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

.11 Internal Wiring

.1 Panel wiring shall be installed in a neat and orderly manner.

.2 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.3 No more than two (2) conductors may be terminated under each terminal screw. All internal panel conductors shall be connected to the same side of a terminal block and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.4 All wires and cables inside the control panels shall be identified on both ends with non-erasable markers.

.5 Identification for wire shall be in accordance with the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels. Wrap-around or self-adhesive markers shall not be permitted.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.6 Individual conductors or wires exiting a cable shall be identified using wire and cable tags, with printed labels.

.7 The routing of all analog, digital, power, and networking wiring and cabling inside control panels shall be segregated as much as possible by the type of signal they are carrying.

.8 All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.9 All analog twisted pair wiring shall be 18 AWG shielded such as Belden No. 8760, or approved equal in accordance with B7. Shield wires exiting the jacket must be covered with a black heat shrink and the overall cable at the jacket end must also be covered with a heat shrink.

.10 All 24 VDC or 120 VAC discrete signal wiring shall be 16 AWG TEW stranded conductor.

.11 All 120 Vac power wiring shall be 14 AWG TEW stranded conductor, minimum.

.12 All 24 Vdc power wiring shall be 12 AWG TEW stranded conductor, minimum.

.13 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.14 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door such that there is sufficient slack to minimize strand fatigue and breaking. Each end of the loop shall be properly supported.

.15 Ethernet Patch Cords

.1 Requirements:

.1 Cat-6.

.2 Jacket colour: Blue.

.16 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or approved equal in accordance with B7.

.2 Wiring duct shall be installed on both sides of the panel and between the DIN rails.

.3 Wire or cable, connected to internal device or arriving from external device, shall be uncovered by wiring duct for a maximum of 10 cm.

.17 Wire ties shall be non-metallic.

.18 Wiring shall be arranged to be readily accessible for inspection and maintenance.

.19 The wiring arrangement shall not interfere with access to panel-mounted devices or spaces for future equipment.

.12 Internal Lighting

.1 All control panels of a depth greater than or equal to 300 mm shall be equipped with a lighting device with a door switch. Whenever the door is opened, the lighting system shall automatically be activated.

.2 Fixture mounting: top-centre of enclosure, unless otherwise noted.

.3 Lights: LED, white.

.4 Manufacturer:

.1 Hoffman,

.2 Or approved equal in accordance with B7.

.13 Overcurrent Protection

.1 Panel-mounted devices and all control circuits shall be protected by appropriately sized fuses or circuit breakers.

Part 3 Execution

3.1 COMPONENT INSTALLATION

.1 Components on the front of the panel shall be identified with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.2 Each component inside the control panel shall be identified with a nameplate corresponding to the Drawings.

.3 All non-DIN rail mountable devices in the control panel shall be mechanically affixed to the back panel with either tapped or self-tapping screws.

.4 All control devices shall be mounted so that any component can be replaced without removing the sub-panel or other components.

.5 Components and/or auxiliary instruments mounted at the rear of the panel shall be readily accessible and their installation shall not be affected by, or interfere with, the removal of any panel instrument.

.6 Nameplates shall be made of hard plastic lamacoid material with a white background and engraved black letters for internal and external components. Refer to section 40 05 01 - Common Work Results – Automation.

.7 Supply and install all required fuses.

.8 Control devices must be spaced adequately to allow for cooling, replacement, servicing, and wiring access.

.9 Control devices shall be grouped according to voltage and function to reduce electrical noise.

.10 Cutouts for instruments shall be within the tolerances specified by the instrument manufacturer.

.11 If cutouts are specified for future instruments, the cutouts shall be covered by removable steel plates 3 mm (1/8 inch) thick. The cover plates shall be finished and painted with the same paint as applied to the front panel.

.12 If any panel-mounted item is not available for installation before the panel is scheduled for shipment, wiring from the terminal block to the panel location for the item shall be completed, wire ends shall be formed exactly to the configurations required, and identifying sleeves shall be applied, ready for connection.

.13 Panel areas designated for future equipment shall be kept clear of stiffening members, rear-mounted equipment, wiring, and all other interferences.

.14 Ample space shall be provided for the entrance of external cables into the panel and for routing the cables to terminating points within the panel.

3.2 IDENTIFICATION

.1 Perform terminal identification using a computerized device. Handwriting is not acceptable.

.2 Label terminals as shown on Drawings.

.3 Install label above each terminal block with terminal block name.

.4 Refer to spec section 40 05 01 for Equipment Identification.

3.3 TESTING

.1 Testing of the control panels shall be completed to the greatest extent possible prior to the FAT and shall include at minimum:

.1 Provide a signed and dated inspection sheet with all tests performed listed on it.

.2 The list of the various test procedures described hereunder is not restrictive and does not relieve the Contractor of his responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.

.3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.

.4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.

.5 Tests to include:

.1 Power supply functionality,

.2 PLC component functionality,

.3 Point to point tests of all inputs and outputs,

.4 Power terminal voltage verification,

.5 Relays and switches functionality,

.6 Receptacle functionality,

.7 Communications / Ethernet switch functionality,

.6 If the panel is modified after tests have been performed, tests shall be repeated.

3.4 SHIPMENT

.1 Request for shipment of any panel having shortages of equipment is subject to approved in writing by the Contract Administrator. The Contract Administrator has sole discretion on either granting approval or not granting approval for shipment.

.2 Contractor is to provide a photo of all control panels from the factory for approval, prior to being shipped to site.

3.5 SPARE COMPONENTS

.1 Supply two spares of each fuse type and rating. Place in a clear plastic bag and attach to the panel door interior

END OF SECTION

Part 1 General

1.1 Description

.1 This section contains requirements for training the City staff, by persons retained by the Contractor specifically for the purpose of proper operation and maintenance of all equipment supplied and installed under this Contract.

.2 The Contract Administrator has the authority to determine if the training is sufficient based on the lesson plan submitted by the Contractor.

.3 Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

1.2 Submittals

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

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to the Contract Administrator 30 Calendar Days prior to anticipated date of beginning of training.

.1 List name of trainers and type of visual and audio aids to be used.

.3 Submit training materials as described in Part 1.5 of this Specification.

1.3 Quality Assurance

.1 Provide competent instructors thoroughly familiar with all aspects of the instrumentation and controls system installed in the facility.

.2 The Contract Administrator reserves the right to review the credentials of the proposed instructor(s) and approved the proposed instructed or request an alternate.

1.4 Instruction

.1 Provide instruction to designated City personnel in adjustment, operation, maintenance, and pertinent safety requirements of the system installed.

.2 The training sessions shall be comprised of both classroom training and field training. As a minimum, they shall cover the following topics for each item of equipment or system:

.1 Safety.
.2 Operation.
.3 Troubleshooting.
.4 Preventative and predictive maintenance.
.5 Corrective maintenance.
.6 Parts.
.7 Local representation.

1.5 Training Materials

.1 Provide equipment, visual and audio aids, and materials necessary for training.

.2 Supply one manual for each trainee (for 20 personnel), plus 3 spare, describing in detail data included in each training program.

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

1.6 Training Program

.1 Operations Training

.1 Location:

.1 McPhillips Pumping Station (360 McPhillips Ave.).

.2 Hurst Pumping Station (60 Hurst Way)

.3 MacLean Pumping Station (875 Lagimodiere Blvd)

.2 Duration: Session is not more than Four hours.

.3 Number of Sessions: Coordinate with Contract Administrator prior to training.

.4 Number of trainees: Coordinate with Contract Administrator prior to training.

.5 Audience: Operations and maintenance personnel.

.6 Content:

.1 General system overview.

.2 Description of system components.

.3 Presentation of the control panel and system operation.

.4 Presentation on the PLC controls.

.5 Presentation on the new chlorine system controls.

.6 Presentation on the motor starters and HVAC operation.

1.7 Monitoring of Training

.1 The Contract Administrator to monitor the training program and may modify the schedule and content.

Part 2 Products

2.1 General

.1 Not Applicable.

Part 3 Execution

3.1 Training

.1 Provide on-site training to City personnel, as indicated above.

END OF SECTION

Part 1 General

1.1 MAINTENANCE SERVICES

.1 Maintain equipment per manufacturer's recommendations up to the final completion of the construction.

1.2 SUPPORT SERVICES

.1 Duration:

.1 The duration of support services is to extend during the warranty period (one year past Total Performance).

.2 Requirements:

.1 Provide telephone support for all products supplied (during regular business hours).

.2 Respond to emergency service calls (during regular business hours).

.3 Telephone Support:

.1 Telephone support to utilize service personnel knowledgeable in the products and have the required troubleshooting skills.

.2 No payment will be made for telephone support during the warranty period.

.4 Emergency Service Calls:

.1 Respond to service calls from the City when the system is not functioning correctly.

.2 Qualified control personnel to be available to provide on-site service upon a critical failure, whenever required.

.1 A critical failure is the inability to operate of any part of the critical system supplied by the Contractor.

.2 Critical systems include, but are not limited to:

.1 Communication networks.

.2 PLC system

.3 Chlorine Detection System.

.3 Perform work continuously until system is restored to a reliable operating condition.

.4 Response Time:

.1 The response time to emergency service calls is to be less than four hours.

.5 Record each service call request, when received separately and include:

.1 Serial number identifying component involved.

.2 Location, date, and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.6 Costs:

.1 If the issue is determined to be due to poor workmanship or defect of the Contractor, no payment will be made to the Contractor.

.2 If the issue is determined to be due to failure of a physical component supplied and is covered under manufacturer's warranty, no payment will be made to the Contractor.

.3 If the issue is determined to be due to an issue outside of the Contractor's responsibility, the Contractor will not be paid for the service call to the Site (or for estimating the required work), but will be paid a mutually agreed upon value to correct the issue, at the discretion of the City.

Part 2 Products

2.1 NOT APPLICABLE.

.1 Not applicable.

Part 3 Execution

3.1 NOT APPLICABLE.

.1 Not applicable.

END OF SECTION