City of Winnipeg
Jessie Flood Pumping Station (FPS) 2024 Upgrades

July 2, 2024
Mark Baker, P.Eng.
Project Manger
Civil / Structural Engineer

July 2, 2024
Peter Goertzen, P.Eng.
Mechanical Engineer

July 2, 2024
Richard Ofstie, P.Eng.
Electrical Engineer

ENGINEERS
GEOSCIENTISTS
MANITOBA
Certificate of Authorization
MPE, a division of Englobe Corp.
No. 4968 Date: July 2,2024

Prepared by MPE, a division of Englobe

CONFIDENTIALITY AND © COPYRIGHT

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Specification shall revise, amend, and supplement the requirements of CW1110.

1.2 REFERENCE STANDARDS

.1 City of Winnipeg General Conditions for Construction, Revision 2020-01-31.

.2 City of Winnipeg Specification CW1110.

1.3 ADMINISTRATIVE

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

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

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

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

.5 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. Submittals not stamped, signed, dated, and identified as to specific project will be returned without being examined and considered rejected.

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

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

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

.9 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by the Contract Administrator’s review.

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

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" as defined in the City’s General Conditions for Construction (Revision 2020-01-31) means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada if requested.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow seven (7) Business Days for review of each submission by the Contract Administrator.

.5 The review by the Contract Administrator of the Shop Drawings is for the sole purpose of ascertaining conformance with the design concept.

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

.7 Make changes in Shop Drawings as the Contract Administrator may require, consistent with Contract. When resubmitting, notify the Contract Administrator in writing of revisions other than those requested.

.8 Accompany submissions with transmittal containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.9 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Section name and clause number equipment is specified under.

.4 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.5 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.6 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.10 After the Contract Administrator’s review, distribute copies as required.

.11 Submit electronic copy of Shop Drawings for each requirement requested in Specification sections and as the Contract Administrator may reasonably request.

.12 Submit electronic copies of product data sheets or brochures for requirements requested in Specification sections and as requested by the Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product.

.13 Submit electronic copies of test reports for requirements requested in Specification sections and as requested by the Contract Administrator.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within [3] years of date of contract award for project.

.14 Submit electronic copies of certificates for requirements requested in Specification sections and as requested by the Contract Administrator.

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

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

.15 Submit electronic copies of manufacturer’s instructions for requirements requested in Specification sections and as requested by the Contract Administrator.

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

.16 Submit electronic copies of manufacturer's field reports for requirements requested in Specification sections and as requested by the Contract Administrator.

.17 Submit documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.18 Submit electronic copies of operation and maintenance data for requirements requested in Specification sections and as requested by the Contract Administrator.

.19 Delete information not applicable to project.

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

.21 If upon review by the Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, a copy will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and resubmission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5 SAMPLES

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

.2 Deliver samples prepaid to Contract Administrator's.

.3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.

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

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

.6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.

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

1.6 MOCK-UPS

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

1.7 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic progress photographs to the Contract Administrator.

.2 Frequency of photographic documentation: weekly & as directed by Contract Administrator.

.1 Upon completion of foundation prior to backfill, reinforcing steel prior to concrete casting, framing and other works prior to concealment.

1.8 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

1.9 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, supplemented with drawings where necessary, the methods to be adopted for executing any portion of Work.

.2 These method statements shall also include details of constructional plan 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.

1.10 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 RFIs or the Contract Administrator considers the RFI to be of such complexity that the Contract Administrator cannot process the RFIs within 14 Calendar Days, the Contract Administrator shall confer with the Contractor within five (5) Calendar Days of receipt of such RFIs 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 RFIs 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.

1.11 CLOSEOUT SUBMITTALS

.1 Refer to Section 01 78 00 – Closeout Submittals for closeout submittal requirements.

1.12 MISCELLANEOUS SUBMITTALS

.1 Prepare and submit submittals required by individual Specification sections.

.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 This specification is to supplement the health and safety requirements contained in the Section D of the Tender Documents, and the City of Winnipeg's "General Conditions for Construction".

1.2 REFERENCE STANDARDS

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Province of Manitoba

.1 The Workers Compensation Act RSM 1987. - Updated 2013.

.3 General Conditions for Construction, City of Winnipeg, Revision 2020-01-31.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit copies of reports or directions issued by federal, provincial, and territorial health and safety inspectors.

.3 Submit copies of incident and accident reports.

.4 Submit WHMIS SDS - Safety Data Sheets where indicated in individual sections.

.5 The Contract Administrator will review Contractor's site-specific Health and Safety Work Plan and provide comments to Contractor within three (3) business days.

.6 The Contract Administrator's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with the Contract Administrator prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

.1 Do work in accordance with all applicable regulatory requirements.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 The Contract Administrator and the City may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Contractor will be responsible and assume the role prime contractor as described in the Manitoba Workplace Safety and Health Act.

.3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with the Workers Compensation Act, Workplace Safety Regulation, Manitoba.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province of Manitoba and advise the Contract Administrator verbally and in writing.

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise the Health and Safety Co-ordinator and follow procedures in accordance with Acts and Regulations of Province of Manitoba and advise the Contract Administrator verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, a competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 The Health and Safety Co-ordinator’s contact information should be prominently displayed in the construction site office.

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of the Province of Manitoba and in consultation with the Contract Administrator.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by the Contract Administrator.

.2 Provide the Contract Administrator with written report of action taken to correct non-compliance of health and safety issues identified.

.3 The Contract Administrator may issue a stop Work Order if non-compliance of health and safety regulations is not corrected.

1.14 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from the Contract Administrator.

1.15 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

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 INSPECTION

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

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections, or approvals by the Contract Administrator or inspection authorities.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections, or approvals before such is made, uncover such Work at no additional cost and have inspections or tests satisfactorily completed and make good such Work.

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

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by the Contract Administrator for purpose of inspecting and/or testing portions of Work. The Contract Administrator will be copy furnished of all inspection and/or testing results and correspondence from the inspection/testing agency. Additional tests required due to defective Work shall be paid by the Contractor at no additional cost to the Contract.

.2 The maximum allowed markup by the Contractor is 10% of the inspection/testing subcontractor cost. If additional inspection and/or tests are required due to defective Work by the Contractor, the additional costs will be borne by the Contractor.

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

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

.5 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 inspection authorities shall have access to the Work.

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

1.4 REJECTED WORK

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

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

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

1.5 REPORTS

.1 Submit four [4] copies of inspection and test reports to the Contract Administrator, prior to inclusion with the operation and maintenance manuals, and in accordance with Section 01 33 00 – Submittal Procedures.

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

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.

.2 Submittals to include but are not limited to:

.1 Site plan as described in Part 1.2.

.2 Shop Drawings, including scaffolding and/or platforms as described in Part 1.3.

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.

.1 Identify areas which have to be gravelled to prevent tracking of mud.

.2 Indicate use of supplemental or other staging area.

.2 Provide construction facilities in order to execute work expeditiously.

.3 Remove from site all such work after use.

.4 Restore grassed areas damaged from construction activities.

1.3 SCAFFOLDING AND TEMPORARY PLATFORMS

.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/or platforms in accordance with Section 01 33 00 – Submittal Procedures where requested on the Drawings.

1.4 SITE STORAGE/LOADING

.1 Confine work and operations of employees to the scope of the Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

.3 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.

.4 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.

1.5 CONSTRUCTION PARKING

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

.2 Provide and maintain adequate access to project site including fire route access.

1.6 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

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

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

.4 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 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.

.6 Maintain in clean condition.

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

1.7 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.

1.8 SANITARY FACILITIES

.1 The Contractor shall provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.1 The Contractor shall post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.9 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by the Contract Administrator.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor shall be responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control should be adequate to ensure safe operation at all times.

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 one week 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.

1.13 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosures using construction grade lumber framing and exterior grade fir plywood to CSA O121.

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

1.4 GUARD RAILS AND BARRICADES

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

.2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts, and other openings in floors and roofs. Provide protection for the interior of the pumping station and existing equipment during re-roofing works (during removal of existing roof and installation of the new roof).

.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, if applicable.

1.6 DUST TIGHT SCREENS

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

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

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

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

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with the Contract Administrator locations and installation schedule three (3) Business Days prior to installation.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Approved: 2006-03-31

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit written request in advance of cutting or alteration which affects:

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

.3 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of the City or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

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.

1.3 PREPARATION

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

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

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

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

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

1.4 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

.5 Remove samples of installed Work for testing.

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

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

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

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

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

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

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material with approved fire stopping assembly.

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

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

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

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

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

.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 and debris.

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19- Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.2 FINAL CLEANING

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

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

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

.4 Remove waste products and debris.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed the Contract Administrator. Do not burn waste materials on site.

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

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

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

.9 Clean roofs, downspouts, and drainage systems.

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

.11 Remove snow and ice from access to building.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling or reuse in accordance with Section 01 74 19-Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Text, schedules, and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects that may include:

.1 Diversion of Materials;

.2 Materials Source Separation Program (MSSP); and

.3 Canadian Governmental Responsibility for the Environment Resources.

1.2 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction.

.3 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.4 Recyclable: Ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

.5 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.6 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

.7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for the purpose of reuse or recycling.

.8 Source Separation: Acts of keeping different types of waste materials separate beginning from the first time they become waste.

1.3 SUBMITTALS

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

1.4 MATERIALS SOURCE SEPARATION PROGRAM

.1 Prepare Material Source Separation Program and have ready for use prior to Project start up.

.2 Implement Material Source Separation Program for waste generated on Project in compliance with approved methods and as reviewed by Contract Administrator. Provide

on Site facilities for collection, handling and storage of anticipated quantities of reusable and recyclable materials.

.3 Provide containers to deposit reusable and recyclable materials.

.4 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.5 Locate separated material(s) in area(s) which minimize material damage.

.6 Collect, handle, store on Site and transport off site, salvaged materials in separate condition.

.7 Transport to approved and authorized recycling facility.

.8 Collect, handle, store on Site and transport off site, salvaged materials in combined condition.

.9 Ship material(s) to Site operating under Certificate of Approval or as directed by the City of Winnipeg.

.10 Materials must be immediately separated into required categories for reuse or recycling.

1.5 WASTE PROCESSING SITES

.1 Identify appropriate waste processing sites, based on municipal requirements, as required.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Store materials to be reused, recycled, and salvaged in locations as directed by Contract Administrator.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store, and catalogue salvaged items.

.4 Separate non salvageable materials from salvaged items. Transport and deliver non salvageable items to licensed disposal facility.

.5 Protect structural components not removed for demolition from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Contract Administrator.

.7 Protect surface drainage, mechanical and electrical from damage and blockage.

.8 Separate and store materials produced during dismantling of structures in designated areas.

.9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.10 On Site source separation is recommended.

.11 Remove co-mingled materials to offsite processing facility for separation.

.12 Provide waybills for separated materials.

1.7 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner or excavation material into waterways, storm or sanitary sewers.

.3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.4 Prepare project summary to verify destination and quantities on a material by material basis as identified in pre demolition material audit.

.5 Dispose of waste in accordance with Municipal and Provincial regulations.

1.8 USE OF SITE AND FACILITIES

.1 Execute Work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility and provide temporary security measures approved by Contract Administrator as required.

1.9 SCHEDULING

.1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work and leave Work area in clean and orderly condition.

.2 Clean-up Work area as Work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 OPERATION AND MAINTENANCE MANUALS

.1 General

.1 Provide operation and maintenance manuals in accordance with Section 01 33 00 – Submittal Procedures.

.2 An electronic draft copy of the operation and maintenance manuals shall be submitted (word version, if available) two (2) weeks prior to Substantial Performance of the Work for review and comments. Submission of individual data will not be accepted unless directed by the City. Make changes and incorporate the Contract Administrator's review comments as required and re-submit as directed by the Contract Administrator

.3 After review and acceptance by the City, five (5) 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 Prepare operation and maintenance manuals using personnel experienced in maintenance and operation of described products.

.5 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.

.6 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.

.7 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.

.2 Format

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf, 8.5" by 11" with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings.

.1 Identify contents of each binder on spine and face.

.4 Cover: identify each binder with 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.

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

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

.7 Text: manufacturer's printed data or type written data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.3 Contents

.1 For each operation and maintenance manual volume, provide an overall title sheet that includes:

.1 The title "Operation and Maintenance Instructions";

.2 Project name and date;

.3 Facilities covered in the manual;

.4 City’s Contract number;

.5 Addresses and telephone numbers of the Contract Administrator and Contractor with name of responsible parties; and

.6 Schedule of products and systems, indexed to content of volume;

.2 For each operation and maintenance manual volume, provide an overall list of contents which includes the contents for all the operation and maintenance manual volumes.

.3 In addition to operation and maintenance information required in the individual Specification sections, include:

.1 Brochures/catalogue excerpts of all components of the Work.

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

.3 Documentation of all test results.

.4 Complete set of equipment and assembly drawings.

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

.6 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.

.7 Sections for the record Drawings and as-built Drawings of all installations. Drafted record Drawings and as-built Drawings of size 432x279 mm (11 x 17”) will be inserted by the Contract Administrator, based on the as-built Drawings marked up by the Contractor.

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

.9 Certificate of Inspection from the inspection authority.

.10 Testing and commissioning documentation.

.11 Warranty certificate, signed and dated.

.12 Written process narratives outlining the programming of the PLC systems for individual processes or systems.

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

.1 Unit

.2 Scale

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

.4 4-20 mA settings

.14 Logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 – Quality Control.

.4 General catalog data for the operations and maintenance manual is unacceptable. If manufacturer’s specification sheets are generalized in any way, they shall be clearly marked to show exactly which item has been supplied, and the project designation for that item (e.g., SF-Y601) is to be noted on manufacturer’s specification sheet which includes all details for this unit, including complete model number, serial number, and construction and performance data.

.4 Equipment and System

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics, and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

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

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 Include summer, winter, and any special operating instructions.

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

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

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

.14 Additional requirements: as specified in individual Specification sections.

.5 Materials and Finishes

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.1 Provide information for re-ordering custom manufactured products if applicable

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

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

.4 Additional requirements: as specified in individual Specifications sections.

1.2 AS -BUILT / RECORD DRAWINGS

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

1.3 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty meeting, to the Contract Administrator for approval.

.3 Warranty management plan to include required actions and documents to assure that the City receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit warranty information, made available during construction phase, to the Contract Administrator for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

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

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

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

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

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with the City's permission, leave date of beginning of time of warranty until date of Total Performance is determined.

.8 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers, or suppliers involved.

.2 Listing and status of delivery of certificates of warranty for warranty items, to include roofs, HVAC balancing, pumps, and commissioned systems. Provide list for each warranted equipment, item, feature of construction, or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.3 Contractor's plans for attendance at four (4) and nine (9) month post-construction warranty inspections.

.4 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.9 Respond in timely manner to oral or written notification of required construction warranty repair work.

.10 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Contract Administrator to proceed with action against the Contractor.

1.4 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by the Contract Administrator.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.
.2 Model number.
.3 Serial number.
.4 Contract number.
.5 Warranty period.
.6 Inspector's signature.
.7 Construction Contractor.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Related Requirements

.1 Section E12

.3 Acronyms:

.1 Cx - Commissioning.

.2 EMCS - Energy Monitoring and Control Systems.

.3 O&M - Operation and Maintenance.

.4 PI - Product Information.

.5 PV - Performance Verification.

.6 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the O&M Manual.

.3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Section 01 91 13.13- Commissioning (Cx) Plan.

.2 For Cx responsibilities refer to Section 01 91 13.13- Commissioning (Cx) Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

.4 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built [facility] is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.6 The Contract Administrator will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by the Contract Administrator.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Contract Administrator, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review Contract Documents, confirm by writing to the Contract Administrator.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation the Contract Administrator.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems, submit TAB reports to the Contract Administrator for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform the Contract Administrator in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections the Contract Administrator before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than four (4) weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to the Contract Administrator for changes to submittals and obtain written approval at least [8] weeks prior to start of Cx.

.3 Submit proposed Cx procedures to the Contract administrator where not specified and obtain written approval at least eight (8) weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by the Contract Administrator.

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 13.16- Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.

.2 Contract Administrator to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to the Contract Administrator.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with 479-2024 Bid Opportunity D12, Detailed Work Schedule.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: 479-2024 Bid Opportunity D12, Detailed Work Schedule and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage, Contract Administrator to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Cx Agent, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60 % and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing, and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide twenty-one (21) days notice prior to commencement.

.2 Contract Administrator and the City to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval the Contract Administrator.

.3 Arrange for the Contract Administrator to witness tests.

.4 Obtain written approval of test results and documentation from the Contract Administrator before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with the Contract Administrator.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from the Contract Administrator after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected the Contract Administrator. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by the Contract Administrator.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by the Contract Administrator.

.3 If evaluation report concludes that major damage has occurred, the Contract Administrator shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to the Contract Administrator for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Contract Administrator to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit to the Contract Administrator for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

.1 Notify the Contract Administrator at least twenty-one (21) days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to the Contract Administrator for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

.1 The Contract Administrator and the City shall witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to the Contract Administrator within five (5) days of test and with Cx report.

1.23 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.24 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of the Contract Administrator.

.2 Report problems, faults or defects affecting Cx to the Contract Administrator in writing. Stop Cx until problems are rectified. Proceed with written approval from the Contract Administrator.

1.25 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by the Contract Administrator.

1.26 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.27 TRAINING

.1 In accordance with Section 01 91 13.83- Commissioning (Cx) - Training.

1.28 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.29 OCCUPANCY

.1 Cooperate fully with the Contract Administrator during stages of acceptance and occupancy of facility.

1.30 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with the Contract Administrator.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.31 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.32 CITY'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by the contract Administrator will not relieve Contractor from compliance with specified start-up and testing 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 SUMMARY

.1 Section Includes:

.1 Description of overall structure of Plan and roles and responsibilities of commissioning team.

.2 Related Requirements

.1 479-2024 Bid Opportunity.

1.2 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

.2 Hydraulic Institute (ANSI/HI)

.1 9.6.3 [17], Rotodynamic Pumps – Guideline for Operating Region

.2 9.6.4 [16], Rotodynamic Pumps for Vibration Measurements and Allowable Values

.3 14.6 [22], Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

.3 National Fire Protection Association (NFPA)

.1 NFPA 820 [16], Fire Protection in Wastewater Treatment and Collection Facilities

.4 Public Works and Government Services Canada (PWGSC)

.1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-[03] .

1.3 GENERAL

.1 Provide a fully functional pumping station:

.1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.

.2 O&M personnel have been fully trained in aspects of installed systems.

.3 Optimized life cycle costs.

.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O&M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements.

.5 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.

.2 EMCS - Energy Monitoring and Control Systems.

.3 HMI – Human Machine Interface

.4 O&M – Operation and Maintenance.

.5 PI - Product Information.

.6 PLC – Programmable Logic Controller

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

.9 WHMIS - Workplace Hazardous Materials Information System.

.10 WHMIS Safety Data Sheets (SDS).

.5 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 100% completed within eight (8) weeks of award of contract to take into account:

.1 Approved shop drawings and product data.

.2 Approved changes to contract.

.3 Contractor's project schedule.

.4 Cx schedule.

.5 Contractor's, sub-contractor's, suppliers' requirements.

.6 Project construction team's and Cx team's requirements.

.2 Submit completed Cx Plan to the OCntract Administrator and obtain written approval.

1.5 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:

.1 Changes resulting from Client program modifications.

.2 Approved design and construction changes.

.2 Revise, refine and update during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to the Contract Administrator for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Contract Administrator to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.1 Contract Administrator is responsible for:

.1 During construction, will conduct periodic site reviews to observe general progress.

.2 Monitoring operations Cx activities.

.3 Ensures Cx activities are carried out to ensure delivery of a fully operational pump station including:

.1 Review of Cx documentation from operational perspective.

.4 Witnessing, certifying accuracy of reported results.

.5 Witnessing and certifying TAB and other tests.

.6 Ensuring implementation of final Cx Plan.

.7 Witnessing verification of performance of installed systems and equipment.

.8 Ensuring implementation of Training Plan.

.9 Training on the HMI, PLC panel selector switches, and standalone level controllers located within the PLC panel.

.10 Commissioning of the HMI, PLC, and standalone level controllers.

.2 Construction Team: contractor, subcontractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:

.1 Testing.

.2 TAB.

.3 Organizing Cx.

.4 Performance of Cx activities to ensure delivery of a fully operational pump station including:

.1 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation

.2 Protection of health, safety and comfort of occupants and O&M personnel.

.5 Delivery of training and Cx documentation.

.6 Assigning one person as point of contact with Contract Administrator and PWGSC Cx Manager for administrative and coordination purposes.

.3 Contractor's Cx agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training, except as noted below.

.1 HMI training, PLC panel selector switches training, and training on the standalone level controllers located within the PLC panel.

.3 Testing.

.4 Development of Cx documentation.

.5 Preparation, submission of test reports.

.6 Developing O&M Manual.

.4 The City: represents lead role in Operation Phase and onwards and is responsible for:

.1 Receiving the completed facility.

.2 Day-To-Day operation and maintenance of facility.

1.7 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:

.1 Installation contractor/subcontractor:

.1 Equipment and systems except as noted.

.1 HMI screens, PLC Control panel, PLC panel selector switches, and standalone level controllers commissioning shall be in the scope of the Contract Administrator.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.

.1 To include performance verification.

.1 Flood Pumps P-F01, P-F02, P-F03

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:

.1 Modify ventilation rates.

.2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:

.1 Modify ventilation rates.

.2 Changes to heating or cooling loads beyond scope of EMCS.

.3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.

.5 Provide names of participants to the Contract Administrator and details of instruments and procedures to be followed for Cx [3] months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

.1 Commission mechanical systems and associated equipment including but not limited to:

- .1 Process pumping systems on new starters:
  - .1 Flood Pumps (P-F01, P-F02, P-F03)
- .2 Plumbing systems:
  - .1 Domestic CWS.
  - .2 Sump pumps (P-F04)
- .3 HVAC systems:
  - .1 HVAC systems
    - .1 Fans
    - .2 Unit Heaters
    - .3 Duct Heaters
    - .4 Dampers
    - .5 Filters
    - .6 HVAC Controls
- .4 Fire and life safety systems:
  - .1 Fire extinguishers.

.2 Commission electrical systems and equipment:

- .1 Medium voltage above 750 V:
  - .1 Service Transformer.
  - .2 MV switchgear.
- .2 Low voltage below 750 V:
  - .1 Low voltage equipment.
  - .2 Low voltage distribution systems.
  - .3 Motor control centres.
  - .4 Motor control field devices.
- .3 Emergency power generation systems:
  - .1 Transfer switchgear.
  - .2 Uninterruptible power systems.
- .4 Lighting systems:
  - .1 Lighting equipment.
  - .2 Distribution systems.
  - .3 Emergency lighting systems, including battery packs.

1.9 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:

.1 Compile English documentation.

.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.

.2 Project record documentation.

.3 Inventory of spare parts, special tools and maintenance materials.

.4 Maintenance Management System (MMS) identification system used.

.5 WHMIS information.

.6 WHMIS Safety Data Sheets (SDS).

.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:

.1 Cx as used in this section includes:

.1 Cx of components, equipment, systems, subsystems, and integrated systems.

.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:

.1 Cx Specifications.

.2 Startup, pre-Cx activities and documentation for systems, and equipment.

.3 Completed installation checklists (ICL).

.4 Completed product information (PI) report forms.

.5 Completed performance verification (PV) report forms.

.6 Results of Performance Verification Tests and Inspections.

.7 Description of Cx activities and documentation.

.8 Description of Cx of integrated systems and documentation.

.9 Training Plans.

.10 Cx Reports.

.11 Prescribed activities during warranty period.

.4 Contract Administrator to witness and certify tests and reports of results provided to Departmental Representative.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:

.1 Pre-Start-Up inspections: by Contractor prior to permission to start up and rectification of deficiencies to the Contract Administrator’s satisfaction.

.2 Contractor to use approved check lists.

.3 Contract Administrator will monitor all of these pre-start-up inspections.

.4 Include completed documentation with Cx report.

.5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by the Contract Administrator and does not form part of Cx specifications.

.6 Contract Administrator will monitor some of these inspections and tests.

.7 Include completed documentation in Cx report.

.2 Pre-Cx activities - MECHANICAL:

.1 Process pumping systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 Complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.2 Plumbing systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 Complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.3 HVAC equipment and systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 At this time, complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.4 Perform TAB on systems. TAB reports to be approved the Contract Administrator.

.4 EMCS:

.1 EMCS trending to be available as supporting documentation for performance verification.

.2 Perform point-by-point testing in parallel with start-up.

.3 Carry out point-by-point verification.

.4 Demonstrate performance of systems, to be witnessed by the Contract Administrator prior to start of thirty (30) day Final Acceptance Test period.

.5 Perform final Cx and operational tests during demonstration period and thirty (30) day test period.

.6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

.3 Pre-Cx activities -FIRE AND LIFE SAFETY SYSTEMS

.1 No pre-Cx activities.

.4 Pre-Cx activities - ELECTRICAL:

.1 Medium voltage distribution systems over 750 V:

.1 Requires independent testing agency to perform pre-energization and post-energization tests.

.2 Requires approval by Manitoba Hydro prior to primary connection.

.2 Low voltage distribution systems under 750 V:

.1 Requires independent testing agency to perform pre- energization and post-energization tests.

.3 Emergency power generation systems

.1 Transfer switches: test of manual operation of switch.

.4 Lighting systems:

.1 Emergency lighting systems:

.1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.

.5 Automation systems: these include:

.1 Instrumentation calibration.

.2 Control panel loop checks and field wiring connections for process and HVAC.

.3 Communications between the pumping station and the City’s SCADA system.

1.12 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:

.1 PLC control panel, HMI screens, and standalone level controllers shall be started up under the supervision of the Contract Administrator. Contract Administrator shall perform commissioning of the PLC control panel and standalone level controllers.

.3 Contract Administrator to monitor some of these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of the Contract Administrator.

.4 Performance Verification (PV):

.1 Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to the Contract Administrator.

.2 Use modified generic procedures to suit project requirements.

.3 Contract Administrator to witness and certify reported results using approved PI and PV forms.

.4 Contract Administrator to approve completed PV reports.

.5 Contract Administrator reserves the right to verify up to 30% of reported results at random.

.6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency using procedures developed by the Contract Administrator.

.2 Contract Administrator to monitor Cx activities.

.3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.

.4 Cx agency to witness, certify reported results of, Cx activities and forward to the Contract Administrator.

.5 Contract Administrator reserves right to verify a percentage of reported results at no cost to contract.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

.1 Cx to be performed by specified Cx specialist, using procedures developed by Cx agency and approved by the Contract Administrator.

.2 Tests to be witnessed by the City and the Contract Administrator and documented on approved report forms.

.3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Cx agency and submitted to the Contract Administrator for review.

.4 Contract Administrator reserves the right to verify percentage of reported results.

.5 Integrated systems to include:

.1 HVAC and associated systems forming part of integrated HVAC systems.

.2 Transfer switch.

.3 Lighting and Emergency lighting systems.

.4 Automation systems.

1.15 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section 01 91 13.16- Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Refer to Section 01 91 13.16- Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.17 PERFORMANCE VERIFICATION (PV) REPORT

.1 Refer to Section 01 91 13.16- Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.18 CX SCHEDULES

.1 Prepare detailed Cx Schedule and submit to Contract Administrator for review and approval same time as project Construction Schedule. Include:

.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:

.1 Cx agents' credentials: sixty (60) days before start of Cx.

.2 Cx procedures: three (3) months after award of contract.

.3 Cx Report format: three (3) months after contract award.

.4 Submission of list of instrumentation with relevant certificates: twenty-one (21) days before start of Cx.

.5 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.6 Notification of intention to start Cx: fourteen (14) days before start of Cx.

.7 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed fourteen (14) days before start of integrated system Cx.

.8 Identification of deferred Cx.

.9 Implementation of training plans.

.10 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to the City.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

.3 Contract Administrator, Contractor, Contractor's Cx agent, and will monitor progress of Cx against this schedule.

1.19 CX REPORTS

.1 Submit reports of tests, witnessed and certified Cx agency to the Contract Administrator who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Contract Administrator.

1.20 ACTIVITIES DURING WARRANTY PERIOD

.1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:

.1 Fine tuning of HVAC systems.

1.21 TESTS TO BE PERFORMED BY THE CITY

.1 Refer to Section 01 91 13.18 – Commissioning Training.

1.22 TRAINING PLANS

.1 Refer to Section 01 91 13.18- Commissioning Training.

1.23 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of the Contract Administrator, lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system, and integrated system.

.2 Related Requirements

.1 479-2024 Bid Opportunity

.2 Section 40 80 11 – Automation - Commissioning

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Contract Administrator supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to the Contract Administrator. Check lists will be required during Commissioning and will be included in Operation and Maintenance Manual (O&M) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the O&M Manual at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Contract Administrator’s approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Contract Administrator's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

.1 Example commissioning forms have been provided as part of this Bid Opportunity. The contractor is to develop commissioning forms based on the provided examples. The following equipment categories are representative of the forms that may be required but not limited to:

- .1 Process Pumping System Commissioning Forms:
  - .1 Process Pumps
  - .2 Valves
  - .3 Level Gauge
- .2 Plumbing System Commissioning Forms:
  - .1 Water Meter
  - .2 Valves
  - .3 Sump Pump
- .3 HVAC System Commissioning Forms:
  - .1 Fans
  - .2 Air Conditioning Unit
  - .3 Unit Heater
  - .4 Duct Heater
  - .5 Dampers
  - .6 Filter
  - .7 HVAC controls
- .4 Fire and Life Safety Systems Commissioning Forms:
  - .1 Fire extinguishers
- .5 Medium Voltage (above 750V) Commissioning Forms
  - .1 Utility Entrance Switchgear
  - .2 Service Transformer
- .5 Low Voltage (below 750V) Commissioning Forms
  - .1 Low voltage equipment
  - .2 Low voltage distribution systems
  - .3 Motor control centres
  - .4 Motor control field devices
- .6 Emergency Power Generation Systems

.1 Transfer switchgear

.2 Uninterruptible power systems

.7 Lighting Systems

.1 Lighting equipment.

.2 Distribution systems.

.3 Emergency lighting systems, including battery packs.

.8 Automation systems and equipment:

.1 Process instrumentation calibration sheets.

.2 Process instrumentation loop checks

.3 PLC control panels

.1 PLC Control Panel and standalone level controllers shall be commissioned by the Contract Administrator. As part of the loop check procedure, Contractor shall assist/collaborate with Contract Administrator to verify functionality of each PLC input/output to the instrumentation device in the field.

.2 Revise items on Commissioning forms to suit project requirements.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from the Contract Administrator, develop appropriate verification forms and submit to the Contract Administrator for approval prior to use.

.1 Additional commissioning forms to be in same format as provided by Contract Administrator.

1.7 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Commissioning agent provides project-specific Commissioning forms with Specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and signed off by Contract Administrator.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Provide Contract Administrator originals of completed forms.

.12 Maintain copy on site during start-up, testing and commissioning period.

.13 Forms to be both hard copy and electronic format with typed written results in Operations and Maintenance Manual in accordance with Section 01 78 00-Closeout Submittals.

1.8 LANGUAGE

.1 To suit the language profile of the awarded contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Commissioning Training

.2 Related Requirements

.2 Section E12

.3 Section 40 80 11 – Automation - Commissioning

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining the facility. Includes facility managers, operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Contract Administrator will provide:

.1 Operator training on HMI screens; navigation and general use.

.2 Operator training on PLC panel selector switches

.3 Operator training on standalone level controllers

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment, and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis, and troubleshooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 TAB and PV Reports.

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

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 4 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Contract Administrator will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Contract Administrator.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Functional requirements.

.2 System philosophy, limitations of systems and emergency procedures.

.3 Review of system layout, equipment, components and controls.

.4 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.5 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.6 Maintenance and servicing.

.7 Trouble-shooting diagnosis.

.8 Inter-Action among systems during integrated operation.

.9 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Scheduling of work: Division 1.
.2 Submittals: Division 1.
.3 Temporary facilities: Division 1.

1.2 REFERENCE STANDARDS

.1 CSA S350-M1980 (R1998), Code of Practice for Safety in Demolition of Structures.

1.3 EXISTING CONDITIONS

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this Section.

1.4 SUBMITTALS

.1 Where required by authorities having jurisdiction, submit for approval, drawings, diagrams, details and supporting data clearly showing sequence of demolition and removal work of building supporting structures and underpinning. Provide Minister with copy of such drawings.

1.5 PROTECTION

.1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.

.2 Cease operations and notify Minister if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Minister.

.3 Ensure safe passage of building occupants around area of demolition.

.4 Cease operations and notify the Minister immediately for special protective and disposal instructions when asbestos materials or other hazardous materials are uncovered during the work of this project.

.5 Prevailing weather conditions and weather forecasts shall be considered. Demolition work shall not proceed when weather conditions constitute a hazard to the workers and site.

.6 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems which remain in operation.

.7 Temporarily suspended work that is without continuous supervision, shall be closed to prevent entrance of unauthorized persons.

1.6 SALVAGEABLE AND RECYCLABLE MATERIALS

.1 Except where otherwise specified, all materials indicated or specified to be permanently removed from the Place of the Work shall become Contractor's property. Maximize to the fullest extent possible, salvage and recycling of such materials, consistent with proper economy and expeditious performance of the Work.

.2 Contractor shall pay for disposal costs.

2. PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment as required to perform work of this section.

3. EXECUTION

3.1 EXISTING SERVICES

.1 Essential Services: Maintain all essential services to all areas.

.2 In each case notify the affected utility company in advance and obtain approval where required, before commencing with the work on main services.

3.2 DEMOLITION

.1 Remove and dispose of the following:

.1 existing gravel, BUR roof membrane, insulation, vapour retarder to expose the existing sloped concrete topping.
.2 existing sheet metal flashings including square-to-round flashings and storm collars.
.3 abandoned equipment and curbs as identified on Drawings.
.4 other materials as required to perform the work.

.2 Carry out demolition work in accordance with CSA S350, unless otherwise specified.

.3 Remove from the site all materials indicated to be removed.

.4 Carry out demolition in a manner to minimize inconvenience to adjacent occupied space.

.5 Carry out demolition in an orderly and careful manner.

.6 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated runoff or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.7 Lower waste materials in a controlled manner; do not drop or throw materials from heights.

.8 Burning of materials on site is not permitted.

3.3 RESTORATION

.1 Restore to its original condition any portion of the building demolished unnecessarily, at no expense to the Minister.

.2 Immediately as the work progresses, repair all vibration and excavation damages to existing adjacent properties and active underground services.

3.4 CLEAN-UP

.1 For clean-up during demolition and for final cleaning, comply with requirements of Division 1.

END OF SECTION

1. GENERAL

1.1 INTENT

.1 Read this section in conjunction with other sections for location, use and placement of chain link fencing specified herein.

1.2 DETAILED DRAWINGS

.1 Following detail drawings are appended hereto and form part of this section.

Number	Title
02821.02	Chain Link Fence Mangate

2. PRODUCTS

2.1 STANDARDS

.1 Steel Pipe to ASTM A53-96.

.2 Chain Link Fabric to CAN2-138.1-96.

.3 Fence, Chain Link, Frame Work, Zinc-Coated Steel to CAN2-138.2-96.

.4 Fence, Chain Link Installation to CAN2-138.3-96.

2.2 MATERIALS

.1 Pipe: Steel butt weld, Schedule 40, hot dip galvanized to 550 g/m^2 coating.

.2 Mesh Wire: Galvanized steel wire hot-dipped galvanized to 490 g/m^2.

.3 Concrete: Sulphate resistant Portland cement, 20 MPa @ 28 days, 50 mm to 80 mm slump, 20 mm aggregate, 6% air entrainment.

2.3 COMPONENTS

.1 Line Posts: 48 mm O.D.,4.05 kg/m.

.2 Corner, Terminal and Straining posts: 73 mm O.D., 8.62 kg/m.

.3 Gate Posts: 73 mm O.D., 8.62 kg/m.

.4 Top and Brace Rail: 33 mm O.D., 2.51 kg/m.

.5 Gate Frame: 42 mm O.D., 3.38 kg/m. Gate leaves to have horizontal and vertical intermediate brace on gate leaves 3.0 m wide and over.

.6 Post Caps: Cast aluminum, sized to post diameter, set screw retained.

.7 Extension Arms: not required

.8 Line Post Eye tops: Cast aluminum.

.9 Rail Ends: Cast aluminum.

.10 Fittings: Sleeves, bands, clips, tension bars, fasteners and fittings galvanized steel.

.11 Fabric: 50 mm diamond mesh, interwoven 3.5 mm wire, top selvage twisted tight, bottom selvage knuckle end closed.

.12 Bottom tension Wire: 5.0 mm steel single strand hot-dipped galvanized to 490 g/m^2.

.13 Single Gate Hardware: 2 piece latch and latch catch. Gate hinge 180° male and female hardware for padlock.

3. EXECUTION

3.1 INSTALLATION

.1 Install to alignment specified, line posts, corner posts, gate posts and top rails to provide rigid structure for wire mesh fabric and gates.

.2 Maximum spacing of posts:

- 3.05 m on centre for 3.05 m high fence
- 3.05 m on centre for 2.44 m high fence
- 3.05 m on centre for 1.83 m high fence
- 2.44 m on centre for 1.22 m high fence

.3 Install line, corner, straining, terminal and gate posts plumb.

.4 Pass top rail through line post tops to form continuous bracing. Install 150 mm long couplings mid-span at pipe ends.

.5 Brace each gate and corner post back to adjacent line post with horizontal centre brace rail. Install brace rail, one bay from corner and gate posts.

.6 Install 10 mm steel truss rod and truss tightener diagonally from top of gate post back to adjacent line post.

.7 Fasten fabric to top rail, line posts, braces and bottom tension wire with 3.5 mm wire ties at maximum 500 mm on centre.

.8 Attach fabric to corner and gate posts with tension bars and tension bar clips. Stretch fabric between posts at intervals of 30.0 m maximum.

.9 Install straining post at approximately 90 m spacing.

.10 Install gates of sizes shown in the Contract documents using fabric and vertical extension arms to match fence. Install 3 hinges per leaf and hardware specified.

.11 Provide concrete centre rest and drop bolt retainers at centre of double gate openings.

.12 Install sway brace units on gate posts where gate leaves are 4.9 m and over in width.

END OF SECTION

1. GENERAL

1.1 RELATED SELECTIONS

.1 Cast-in-place concrete: Section 03 30 00.

1.2 REFERENCE DOCUMENTS

.1 ACI 315-94 – ACI Detailing Manual

.2 A775/A775M-00 Standard Specification for Epoxy-Coated Reinforcing Steel Bars

.3 CSA A23.1-00 - Concrete Materials and Methods of Concrete Construction

.4 CSA A23.3-94 - Design of Concrete Structures

.5 CAN/CSA-G30.3-M1983 R1998 - Cold-Drawn Steel Wire for Concrete Reinforcement

.6 CAN/CSA-G30.5-M1983 R1998 - Welded Steel Wire Fabric for Concrete Reinforcement

.7 CAN/CSA-G30.18-M92 R1998 - Billet-Steel Bars for Concrete Reinforcement

.8 CAN/CSA-G30.14-M1983 R1998 - Deformed Steel Wire for Concrete Reinforcement

.9 CAN/CSA-G30.15-M1983 R1998 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement

.10 CAN/CSA-G40.21-98 - Structural Quality Steel

.11 CAN/CSA-G164-M92 R1998 - Hot Dip Galvanizing of Irregularly Shaped Articles

.12 CAN/CSA-W186-M1990 R1998 - Welding of Reinforcing Bars in Reinforced Concrete Construction

.13 Reinforcing Steel Institute of Canada - Reinforcing Steel Manual of Standard Practice

1.3 SHOP DRAWINGS

.1 Submit shop drawings including placing of reinforcement in accordance with Division 01.

.2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, bolsters, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.

.3 Detail lap lengths and bar development lengths to CSA A23.3 unless otherwise indicated. Provide type A tension lap splices unless otherwise indicated.

1.4 QUALITY ASSURANCE

.1 Provide Contract Administrator, upon request, with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.

.2 Inform Contract Administrator, upon request, of proposed source of material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle reinforcing steel, welded wire fabric and accessories in manner that prevents contamination which reduces bond, and damage to fabricated forms.

.2 Protect reinforcement from rust, dirt, grease, form oil and other bond-breaking substances.

2. PRODUCTS

2.1 REINFORCEMENT MATERIALS

.1 Provide materials with minimum 25% recycled content.

.2 Reinforcing Steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise; Plain finish.

.3 Reinforcing Steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.

.4 Plain Round Bars: to CAN/CSA-G40.21.

.5 Deformed Steel Wire for Concrete Reinforcement: to CSA-G30.14.

.6 Welded Steel Wire Fabric: to CSA-G30.5. Provide in flat sheets only.

.7 Chairs, Bolsters, Bar Supports and Spacers: to CSA A23.1.

.8 Mechanical Splices: subject to Contract Administrator’s approval.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1, ACI 315, and Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.

.2 Obtain the Contract Administrator’s approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of the Contract Administrator, weld reinforcement in accordance with CAN/CSA-W186.

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

.5 Fabricate within the following tolerances:

.1 Sheared Length: +/- 25mm
.2 Stirrups, Ties and Spirals: +/- 10 mm
.3 Other Bends: +/- 25 mm

.6 Locate reinforcing splices not shown on drawings at points of minimum stress.

3. EXECUTION

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or 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 PLACEMENT DETAILING

.1 Conform to CSA-A23.1 and CSA-A23.3 for hooks, bends laps and similar details not specifically shown.

.2 For support bars not shown on drawings, use the sizes and spacing for applications as follows:

.1 Slab Top Reinforcing (10M): 10M bars spaced at 1000 mm o.c. maximum.

.2 Slab Top Reinforcing (15M and larger): 15M bars spaced at 1200 mm o.c. maximum.

.3 Slab Bottom Reinforcing: 15M bars spaced at 1200 mm o.c. maximum.

.4 Beam Stirrups: 15M bar in each corner.

.3 Reinforce slab and wall openings, unless otherwise shown, as follows:

.1 Openings with greatest dimension of 600 mm or less: four 15M diagonal bars, 900 mm longer than greatest opening dimension.

.2 Openings with greatest dimension larger than 600 mm: two 15M bars on each side, top and bottom, 1500 mm longer than greatest opening dimension.

.3 Reinforce circular openings as square.

.4 Secure chairs for reinforcing in place located at 1200 mm o.c. maximum.

.5 Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars or welded wire fabric around wall and grade beam corners.

.6 Cover electrical conduit, ductwork or piping buried in slabs with 600 mm wide strip of 102 x 102 x MW13.3 x MW13.3 welded wire fabric. If principal slab reinforcement is placed above conduit then place 600 mm strip under conduit. Position of reinforcing steel takes precedence over conduit, ductwork or piping.

3.3 PLACEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1. Chair slab reinforcing not further apart than 1.2 m in either direction.

.2 Place, support and secure reinforcement against displacement. Do not deviate from required position.

.3 Do not displace or damage vapour barrier. Repair and reposition vapour barrier as required.

.4 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.

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

.6 Ensure reinforcement location is maintained to provide required concrete cover to reinforcement during placement of concrete.

.7 Place reinforcing steel in walls, slabs , and columns to provide concrete cover for 1 hour fire endurance, as required by the Alberta Building Code.

.8 Place reinforcing steel to provide concrete cover as follows:

Item	Cover [mm]
Beam Stirrups	[30]
Supported Slabs and Joists	[25]
Column Ties	[40]
Interior Walls	[30]
Walls Exposed to weather or backfill	[40]
Footings and concrete formed against earth	[75]
Slabs on Fill	[50]

.9 Maintain alignment as follows:

Item	Tolerance Plus or Minus
Slabs	5
Other Structural Members	10
Rebar bends and Ends	50

3.4 FIELD TOUCH-UP

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

3.5 CLEANING

.1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.

.2 Remove all loose scale, loose rust and other deleterious matter from surfaces of reinforcing.

END OF SECTION

1. GENERAL

1.1 RELATED SELECTIONS

.1 n/a

1.2 REFERENCE DOCUMENTS

.1 ASTM C109/C109M-08, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

.2 ASTM C295-08, Standard Guide for Petrographic Examination of Aggregates for Concrete.

.3 ASTM C309-08, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C330-05, Standard Specification for Lightweight Aggregates for Structural Concrete.

.5 ASTM C332-07, Standard Specification for Lightweight Aggregates for Insulating Concrete.

.6 ASTM C618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

.7 ASTM C827-01a (2005), Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

.8 ASTM C939-02, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).

.9 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

.10 ASTM D624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

.11 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.12 ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

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

.14 CGSB 81-GP-1M- 77, Flooring, Conductive and Spark Resistant.

.15 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.

.16 CAN/CSA-A23.2-04, Methods of Test for Concrete.

.17 CAN/CSA-A23.3-04, Design of Concrete Structures.

.18 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 SUBMITTALS

.1 Comply with the requirements of Division 1. Requirements and the following:

.2 Mix design

1.4 **QUALITY ASSURANCE**

.1 Cast-in-place concrete to conform to CSA-A23.1

.2 Testing shall conform to CSA-A23.2

.3 These standards shall be available in Contractor's site office for use of Contractor and Contract Administrator.

1.5 **INSPECTION TESTING**

.1 Concrete work may be tested by a testing firm retained by the City.

.2 Submit the following to testing firm:

.1 Proposed concrete mix design.

.3 Provide casual labour to the testing firm's field personnel for the purpose of obtaining and handling sample materials.

.4 Advise testing firm in advance of concrete placement.

.5 Provide and maintain facilities at the site for storage of concrete test cylinders for the first 24 hours.

.6 Provide copies of mill test reports of cement as required.

.7 Secure sufficient three and seven day cylinders for testing by concrete supplier to ensure concrete quality control.

.8 Provide at least one cube test, to ASTM C109/C109M, on grout used under base plates and machinery.

.9 Conduct core tests when required.

.10 Testing firm will do the following for large pours. Engineer to confirm when required:

.1 Take three test cylinders from each 60 m^3 of concrete, or fraction thereof, of each type of concrete placed in any one day.

.2 Take samples of concrete mix close to the point of final deposit in the form. Contractor shall provide suitable access to the work for obtaining samples.

.3 Moist cure and test one cylinder in 7 days and moist cure and test the remaining two cylinders in 28 days.

.4 Take one additional test cylinder when the temperature is likely to fall below 0°C within 48 hours after placing and no provisions have been made to heat the concrete to greater than 10°C. Test cylinder to be cured on job-site under same conditions as concrete it represents and tested in 7 days.

.5 Make at least one slump test and one entrained air test for each set of test cylinders taken.

.11 Results of field tests will be reported immediately to the Contractor by the field representative of the testing firm. These results do not imply approval or disapproval of the work, but are for the Contractor's information. Acceptability of the work will be determined by the Contract Administrator.

.12 Results of concrete tests will be forwarded to the Contract Administrator and to the Contractor. Included with the results will be the following information: Name of Project, Date of Sampling, Name of Supplier, Delivery Truck Number, Identification of Sampling and Testing Technician and exact location in the structure of the concrete sampled.

.13 Testing firm personnel are not authorized to revoke, relax, enlarge or release any requirements of the specification, nor to accept or reject any portion of the work.

.14 Contractor may arrange and pay for additional tests for use as evidence to expedite construction.

1.6 **ACCEPTABILITY**

.1 Failure to comply with the requirements that control strength and durability will result in the structure being considered potentially deficient.

.2 A structure will be considered potentially deficient when:

.1 Concrete used is not as specified in Concrete Mix Schedule in this Section.

.2 Improper curing methods or materials are used.

.3 There has been inadequate protection of concrete from extremes of temperature during early stages of curing and strength development.

.4 There has been mechanical injury from fire, construction overload or premature removal of forms.

.5 Poor workmanship is determined.

.6 Concrete differs from the required dimensions.

.3 Strength evaluation tests and analysis.

.1 The Contract Administrator may order an independent testing firm to obtain cores, x-rays, or similar non-destructive tests.

.2 The Contract Administrator may order a load test and/or analysis as defined by CSA A23.3, Section 18, if the non-destructive tests are impractical or inconclusive.

.3 Reinforce by additional construction or replace as directed by the Contract Administrator at own expense, concrete judged inadequate by structural analysis or by results of load tests.

.4 Pay the cost of testing and/or analysis which is required to demonstrate the adequacy of the structure which does not meet the requirements for strength or which has been placed before formwork and reinforcing have been inspected and approved by the Contract Administrator.

.5 The Contract Administrator may order additional testing at any time even though the required tests indicate that the strength requirements have been met. In this instance the Minister will pay for those tests that meet the specified requirements and the Contractor shall pay for those that do not.

.4 Concrete not conforming to the lines, detail, strength and grade specified herein or as shown on drawings shall be modified or replaced at the Contractor's expense, to the satisfaction of the Contract Administrator.

1.7 **DELIVERY, STORAGE AND HANDLING**

.1 Waste Management and Disposal:

.1 Provide an appropriate area on the job site where concrete trucks can be safely washed.

.2 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Contract Administrator.

.3 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.4 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local regulations.

2. PRODUCTS

2.1 CONCRETE MATERIAL

.1 Portland Cement , Supplementary Cementing Materials, Cementitious Hydraulic Slag: to CAN/CSA-A3000.

.2 Aggregates: to CSA A23.1 and as follows.

.1 Coarse aggregate to be normal density.

.2 Ironstone content of aggregates in exposed interior or exterior concrete subject to intermittent or continuous wetting shall not exceed the following, when tested to ASTM C295:

.1 Coarse Aggregate: maximum 1% by mass.

.2 Fine Aggregate Retained on 2.5 mm Sieve: maximum 1.5% by mass.

.3 Ensure that no aggregates are used which may undergo volume change due to alkali reactivity, moisture retention or other causes. Confirm suitability of aggregate with a petrographic analysis if deemed necessary by the Contract Administrator.

.3 Water: potable, to CSA A23.1.

.4 Admixtures: to CAN/CSA-A23.1. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

.1 Air Entrainment: conforming to CAN 3-A266.1.

.2 Chemical: conforming to CAN 3-A266.2; water reducing, strength increasing type, Superplasticizing.

.3 Pozzolanic Mineral: conforming to CAN/CSA-A23.5.

2.2 CONCRETE ACCESSORIES

.1 Curing Compound: CSA A23.1 clear and to ASTM C309.

.2 Shrinkage Compensating Grout: premixed compound consisting of non metallic aggregate, Portland cement, water reducing and plasticizing agents. Compressive strength of 16 MPa at 24 hours and 50 MPa at 28 days.

.1 Consistency: as follows:

.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 seconds.

.2 Flowable: to ASTM C827. Flow table, 5 drops in 3 seconds, (ASTM C109, applicable portions) 125 to145 %.

.3 Plastic: to ASTM C827. Flow table, 5 drops in 3 seconds, (ASTM C109, applicable portions) 100 to125 %.
.4 Dry pack to manufacturer's requirements.

.2 Net shrinkage at 28 days: maximum 0%.

.3 Bonding Agent: high polymer resin emulsion, mixed with cement mortar or grout to form a water resistant adhesive bond.

.4 Dampproof Membrane Reinforced: 150 micrometre polyethylene film to CAN/CGSB-51.34.

.5 Dampproofing, emulsified asphalt, mineral colloid type: to CAN/CGSB-37.2, and to Section 07 11 13 – Bituminous Dampproofing.

.6 Non-Ferrous Grout: pre-mixed, non-shrink, minimum 35 MPa compressive strength.

2.3 MIX

.1 Supply concrete mix proportioned to produce concrete specified in Concrete Mix Schedule.

.2 Requirements not specified in Schedule shall conform to CSA A23.1.

.3 Use of admixtures, other than air-entraining admixtures, are not permitted without prior approval of the Contract Administrator.

.4 Fly ash up to a maximum of 30% of the total cement content may be used for concrete placed at the following locations:

.1 Piles/Footings: 30%,
.2 Walls/Columns: 25%,
.3 Slabs: 20%,
.4 Toppings: 15%,

.5 Superplasticizers shall be used in strict accordance with the recommendations of the manufacturer. Concrete slump after superplasticizing shall not exceed 200 mm.

.6 All admixtures are subject to Contract Administrator's approval. List all proposed admixtures in mix design submission. Do not change or add admixtures to approved design mixes without Contract Administrator's approval.

3. EXECUTION

3.1 PREPARATION

.1 Obtain Contract Administrator's approval before placing concrete. Provide Contract Administrator and testing agency 2 days notice prior to placing concrete.

.2 Coordinate placement of waterstops, inserts and joint devices with erection of concrete formwork and formwork accessories.

.3 Pumping of concrete is permitted only after approval of equipment and mix.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Prior to placing concrete obtain Contract Administrator's approval of method for protection of concrete during placing and curing.

.6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality of concrete, ambient air temperature and test samples taken.

.7 Clean previously placed concrete with steel brush. Use acid if necessary. Mix and brush on bonding agent in accordance with manufacturer's instructions.

.8 In locations where new concrete is dowelled into existing work, drill holes into existing work. Place deformed steel dowels and pack solid with epoxy grout to anchor and hold dowels in place as indicated.

.9 Do no place load upon new concrete until authorized by the Contract Administrator.

3.2 SLEEVES AND INSERTS

.1 Not used

3.3 ANCHOR BOLTS AND BASE PLATES

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of the Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with epoxy grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

3.4 PLACING CONCRETE

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

.2 Revise, re-seat and correct improperly positioned reinforcing, immediately before placing concrete.

.3 Place concrete as a continuous operation stopping only at construction joints indicated on the drawings or as follows: At center of span of suspended slabs, beams and joists; in walls and columns immediately above or below floor construction; at center of steel beam that supports concrete slab.

.4 Construction joints at center of span of suspended slabs beams and joists shall be adequately doweled and keyed.

.5 Place floor slabs on grade as one continuous pour between construction joints indicated on drawings. Control joints for each pour shall be formed by sawing a continuous 1/4 slab depth slot at 6 m centers each way unless otherwise indicated on drawings. Sawing shall be done as soon as the concrete has sufficiently hardened to prevent raveling of the edges but in no case later than 18 hours after the concrete slab has been placed.

.6 Isolate slabs on grade from vertical concrete using pre-moulded joint fillers extending from bottom of slab to within 12 mm of slab surface unless otherwise indicated.

.7 Use winter concreting methods in accordance with CAN/CSA A23.1 when the mean daily temperature falls below 5°C.

.8 Provide a camber of 0.02% of span for beams unless noted otherwise on drawings.

.9 Provide a camber of 0.01% of span for joists and slabs spanning over 3 m unless noted otherwise on drawings.

.10 Use procedures noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surfaces are not damaged.

.11 Vibrate concrete using the appropriate size equipment as placing proceeds in strict accordance with Clause 19.5 of CSA-A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solidly with non-shrink grout.

.13 Do not place concrete if carbon monoxide producing equipment has been in operation in the building during the 12 hours preceding the pour. This equipment shall not be used during placing, or for 24 hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or by an impermeable membrane from direct exposure to carbon dioxide, combustion gases or drying from heaters.

.14 Honeycomb or embedded debris in concrete is not acceptable.

.15 Remove and replace defective concrete.

3.5 CURING

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

.2 Wet cure flat slabs and floors shown to receive paint

.3 All concrete shall receive moist curing for a period of seven days. One of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:

.1 Surface covered with canvas, burlap or other satisfactory material and kept thoroughly wet.

.2 Surface sealed with polyethylene sheeting and the concrete kept thoroughly wet.

.3 Subject to the approval of the Contract Administrator, a liquid membrane curing compound used in accordance with the manufacturer's recommendations, may be used. Membrane to remain intact during the curing period.

.4 Surfaces of concrete that are protected by formwork which is left in place for seven days shall not require any additional curing except as specified for hot weather. If the formwork is removed in less than seven days, the concrete shall receive moist curing until seven days have elapsed since the concrete was placed.

.5 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.6 Curing compounds shall not be used on concrete surfaces to receive topping or other type of bonded finish unless approved by the Contract Administrator.

.7 Protect freshly placed and consolidated concrete against damage or defacement from adverse weather conditions.

.8 Coat exposed concrete walking surfaces not to receive an integral hardener with curing compound of type that provides permanent seal.

.9 Do not use curing compound in locations where chemical hardener is to be used.

3.16 FINISHING FORMED SURFACES

.1 Upon removal of forms, treat imperfections in formed surfaces in accordance with CSA A23.1 and to Contractor's approval.

.2 Modify or replace concrete not conforming to the quality, lines, details and elevations specified herein or as shown on drawings.

.3 Finish all exposed formed concrete surfaces with sack rubbed finish according to CSA A23.1.

.4 Rough Finish Concrete Surfaces not Exposed to View: Place concrete against forms true and plane. Cut off form ties a minimum of 10 mm below concrete surface. Patch tie holes and defects. Remove fins exceeding 5 mm.

.5 Smooth Finish Overhead Surfaces Exposed to View: Place concrete against plywood, steel or tempered hardboard. Patch tie holes and defects. Remove fins.

3.17 GROUT

.1 Mix non-shrink grout to consistency specified in part 2 of this Section as required for use intended and apply in accordance with manufacturer's instructions. Install under columns, beams and equipment bases as shown on drawings, in accordance with the manufacturer’s recommendations.

3.18 EQUIPMENT PADS, PUMP BASES

.1 Provide concrete pads and bases for equipment where indicated on drawings. Adjust dimensions of pads to reviewed shop drawings.

.2 Cast in anchor bolts with templates where required. Insert bolts and sleeves and pack with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel surfaces smooth. Bullnose edges to smooth radius.

3.19 SLABS ON FILL

.1 not used

3.20 COLD AND HOT WEATHER CONCRETING

.1 Conform to the requirements of CSA A23.1.

.2 Protect slabs being finished during drying conditions above 25° C, and/or during high winds with moisture retention film.

3.21 CONCRETE MIX SCHEDULE

Component	Type	Min Comp Strength @ 28 days (MPa)	Exposure Class	Air Content	Slump Range * (mm)	Nominal Aggregate Size (mm)
Slab Exterior Repair	HS	30	F-2 C-1	4-7 %	40-80	20-5
Interior Structure equipment bases and pads	GU	25	N	None	60-100	20-5

END OF SECTION

1. GENERAL

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 N/A

1.2 DESIGN CRITERIA

.1 Design connections and other work not detailed on drawings, but necessary for completion of the Work, in accordance with requirements of Saskatchewan Building Code, CAN/CSA-S16.1 and CSA S136.

1.3 SUBMITTALS

.1 Comply with requirements of Division 1.

.2 Submit shop drawings and product data prior to commencement of fabrication.

.3 Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.

.4 Shop drawings for work designed by fabricator shall bear the stamp and signature of a Professional Engineer registered in the Province of Saskatchewan.

.5 Submit shop paint primer manufacturer's product data.

1.4 FABRICATOR AND ERECTOR QUALIFICATIONS

.1 Welding shall be undertaken only by a company approved by the Canadian Welding Bureau to the requirements of CSA W47.1, Certification of Companies for Fusion Welding of Steel.

1.5 REFERENCE DOCUMENTS

.1 Comply with applicable requirements of CAN/CSA-S16.1 and CAN/CSA-S136.

.2 Do welding in accordance with CSA W59.

1.6 TESTING AND INSPECTION

.1 Engineer may appoint and pay for services of testing agency to perform testing and inspection of work of this Section.

.2 Notify Engineer prior to commencement of fabrication work so that testing and inspection may be properly scheduled.

.3 When defects are revealed, Engineer may request additional testing and inspection at Contractor's expense.

1.7 COORDINATION

.1 N/A

2. PRODUCTS

2.1 MATERIALS

.1 Steel: Structural quality, to CAN/CSA-G40.20.

.2 Rolled Structural Steel Sections: to CAN/CSA-G40.21, grade 300 MPa.

.3 Hollow Structural Steel Sections: to CAN/CSA-G40.21, grade 350 MPa.

.4 Bolts: to ASTM A668M or ASTM A490M.

.5 Expansion Joint Plates: 6 mm thick dry lubricated brass cut to the shapes required to give full coverage of the bearing surfaces.

.6 Shear Stud Connectors: to ASTM A108.

.7 Shop Paint Primer: to CISC/CPMA 2-75 or CAN/CGSB-1.105.

.8 Fixed Ladder and Cages: to Process Industry Practices Standard STF05501.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CAN/CSA-S16.1 and CSA-S136.

.2 Camber steel members as indicated on drawings.

.3 Shop weld shear stud connectors with automatic stud welding equipment. Thoroughly clean surface to which studs are to be welded. Ensure stud stem is perpendicular to surface to which it is attached.

2.3 SURFACE PREPARATION AND SHOP PRIMING

.1 Where structural steel is scheduled to be finish painted, prepare surfaces in accordance with SSPC-SP6 - Commercial Blast Cleaning.

.2 Apply shop paint primer in accordance with CAN/CSA-S16.1 to a dry film thickness of 50 to 75 micrometers.

3. EXECUTION

3.1 ERECTION

.1 Erect structural steel in accordance with CAN/CSA-S16.1 and CSA-S136.

.2 Obtain Engineer's approval prior to field cutting or altering of members.

.3 Field touch up shop paint primer at bolts, welds and burned or scratched surfaces. Use same primer as applied in shop.

3.2 GALVANIZING

.1 Galvanize according to CSA G-164 and to a minimum coating of 0.61 kilogram per square metre.

.2 Apply zinc rich paint where the galvanized coating has been damaged.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Not Applicable

1.2 REFERENCES

.1 Canadian Standards Association (CSA):

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

.2 CAN/CSA-S157, Strength Design in Aluminum.

.3 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.

.4 CSA W59.2, Welded Aluminum Construction.

.5 CSA W55.3 - Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.108, Bituminous Solvent Type Paint.

.3 American Society for Testing and Materials (ASTM):

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

.2 ASTM A668M Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.

.3 ASTM A 490, Specification for Heat Treated, Steel Structural Bolts, 150 ksi (1035 Mpa) Tensile Strength.

.4 ASTM A 490M, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints Metric.

.5 ASTM B 209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate Metric.

.6 ASTM B 210M, Specification for Aluminum-Alloy Drawn Seamless Tubes Metric.

.7 ASTM B 211M, Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire Metric.

.8 ASTM B 316M Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods Metric

.4 Aluminum Association, Inc. (AA):

.1 Designation System for Aluminum Finishes.

.5 American Welding Society (AWS):

.1 AWS A5.10, Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.

1.3 SHOP DRAWINGS

.1 Shop Drawings:

.1 Submit shop drawings including fabrication and erection documents consisting of connection and design details, shop details, erection diagrams, erection procedures and material lists in accordance with Section 01 33 00 – Submittals.

.2 Indicate cuts, copes, connections, holes, threaded fasteners, rivets, welds and other items. Indicate welds using welding symbols as shown in Appendix A of CSA W59.2.

.3 Submit description of methods, sequence of erection and type of equipment to be used in erecting structural aluminum.

1.4 SAMPLES

.1 Not Applicable.

1.5 QUALITY ASSURANCE

.1 Submit one copy of mill test reports showing chemical and physical properties and other details of aluminum to be incorporated into work, at least 4 weeks prior to fabrication of structural aluminum. Mill test reports shall be certified by metallurgists qualified to practice in the Province of Manitoba, Canada.

2. PRODUCTS

2.1 MATERIALS

.1 Aluminum bar, rod, and wire: to ASTM B 211M.

.2 Aluminum and Aluminum-Alloy Extruded Bar, Rods, Wire, Shapes, and Tubes: to ASTM B 221M.

.3 Aluminum sheet or plate: to ASTM B 209M.

.4 Aluminum drawn tubes: to ASTM B 210M.

.5 Aluminum bolts and rivets: to ASTM B 316M

.6 Aluminum welding wire: to AWS A5.10.

.7 Stainless steel bolts: to AISI Steel Products Manual No. 13.

.8 Steel bolts: to ASTM A 668M.

.9 Bituminous paint: to CAN/CGSB-1.108, type 1, 2, without thinner.

.10 Galvanizing hot dip galvanize steel bolts to CAN/CSA-G164, minimum zinc coating of 600g/m^2.

.11 Grating:

.1 Install grating where indicated on drawings.

.2 Materials

.1 Aluminum Grating to be Type 30-102M.
.2 Bearing Bars: 6063T6
.3 Cross Bars: 6063T5
.4 Maximum allowable fibre stress: 82.82 Mpa
.5 Grating to have smooth top edge.
.6 Fasteners to be Type A fixing clip c/w stainless steel screw, nut, and washer.
.7 Size: 51 x 4.8 unless noted otherwise on drawings
.8 Hinges, fasteners and all hardware to be stainless steel

.12 Ladders:

.1 n/a

.13 Access Hatches:

.1 Install hatches where indicated on drawings.

.2 Applicable Equipment:

.1 Location:

.1 As shown on Drawings

.2 Specified Equipment: **AH-01**

.1 Manufacturer: MSU Mississauga Ltd. or approved equivalent.
.2 Loading: 2.4 kPa min.
.3 Model: BD - Custom – Bolt down on curb
.4 Opening Size: 2620 mm x 2030 mm. Confirm measurements on site.
.5 Doors: 2 (1310mm x 2030mm) reinforced for required loading
.6 Finish: Factory Finish
.7 Body: Aluminum: to ASTM B 221M or B 209M, Alloy 6351-T6.
.8 Tread Plate: Aluminum: ASTM B 221M or B 209M, Alloy 6061-T6.
.9 Miscellaneous: Fasteners, gas spring, and hold open arm in 316

stainless steel; hinges and slam lock in 304 stainless steel.

.10 Accessories:

.1 Padlock: Complete with master padlock and key. All hatches to be keyed alike

.11 Drain Outlet
.1 Exterior drainage

.3 Specified Equipment: **AH-02**

.1 Manufacturer: MSU Mississauga Ltd. or approved equivalent.
.2 Loading: 2.4 kPa min.
.3 Model: BD - Custom – Bolt down on curb
.4 Opening Size: 610 mm x 610 mm. Confirm measurements on site.
.5 Doors: 2 (1310mm x 2030mm) reinforced for required loading
.6 Finish: Factory Finish
.7 Body: Aluminum: to ASTM B 221M or B 209M, Alloy 6351-T6.
.8 Tread Plate: Aluminum: ASTM B 221M or B 209M, Alloy 6061-T6.
.9 Miscellaneous: Fasteners, gas spring, and hold open arm in 316 stainless steel; hinges and slam lock in 304 stainless steel.
.10 Accessories:

.1 Padlock: Complete with master padlock and key. All hatches to be keyed alike

.11 Drain Outlet
.1 Exterior drainage

2.2 FABRICATION

.1 Fabricate in accordance with CAN/CSA-S157 and in accordance with shop drawings.

2.3 FINISHES

.1 Plain mill finish, unless otherwise indicated.

3. EXECUTION

3.1 GENERAL

.1 Structural aluminum work: in accordance with CAN/CSA-S157.

.2 Welding: in accordance with CSA W59.2.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.2 for fusion welding of aluminum and/or CSA W55.3 for resistance welding of structural components.

.4 Paint aluminum surfaces in contact with concrete with two (2) coats of alkali resistant bituminous paint.

3.2 ERECTION

.1 Erect structural aluminum as indicated and in accordance with CAN/CSA-S157 and approved erection drawings.

.2 Field cutting or altering structural members: to approval of the Engineer.

.3 Seal frames to curb with Sikaflex 1A or per manufacturer recommendation.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship may be carried out by testing laboratory designated by Engineer.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Engineer.

END OF SECTION

1. GENERAL

.1 Not Applicable.

2. PRODUCTS

.1 Unless noted otherwise, all bolts and nuts to be cadmium plated. Bolt heads and nuts to be heavy hex conforming to ASTM A307.

.2 Stainless steel bolts are to be used with structural aluminum. See Section 05 14 10.

.3 All steel, plates, bars etc. conforming to CSA - G40.20.

3. EXECUTION

3.1 CATHODIC PROTECTION

.1 Install cathodic protection as shown in the Contract Documents.

.2 Cathodic protection is to be achieved by using prepackaged anodes connected to the valve, fitting or steel pipe in a convenient place.

.3 Install 1 kilogram of high purity ASTM Type II zinc anode for every 4 square metres of soil exposed coated surface.

3.2 GALVANIZING

.1 Galvanize according to CSA G-164 and to a minimum coating of 0.61 kilogram per square metre.

.2 Apply zinc rich paint where the galvanized coating has been damaged.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless;

.2 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service;

.3 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; and

.4 ASTM A108-18, Standard Specification for Steel Bar, Carbon and Alloy, Cold-finished.

.2 CSA Group

.1 CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel;

.2 CAN/CSA-G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles;

.3 CAN/CSA-S16-14, Design of Steel Structures;

.4 CAN/CSA S167-17, Strength Design in Aluminum;

.5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding; and

.6 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

1.3 SUBMITTALS

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

.2 Product Data

.1 Submit Product Data

.2 Submit data sheets for all materials specified in this section.

.3 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

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

.4 Certificates:

.1 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

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

.3 Fabricator and welders must be certified in accordance with CSA and the Canadian Welding Bureau.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job Site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

.3 Store materials off ground in a dry, well-ventilated area.

.4 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

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

.2 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W/350W.

.3 Steel pipe: to ASTM A53/A53M, galvanized finish.

.4 Welding materials: to CSA W59.

.5 Welding electrodes: to CSA W48 Series.

.6 Bolts: to ASTM A307.

.7 Anchor bolts and fasteners: ASTM F1554 Grade 36 (galvanized); ASTM F3125 A325 (galvanized); 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 may be subjected. Existing concrete shall be scanned for rebar location prior to ancho installation in order to avoid interfering and damaging the rebar.

.8 Aluminum: to CSA S157 and the Aluminum Association Specifications for Aluminum Structures.

.9 Aluminum plates: type 6061-T651. Aluminium plate shall have an approved raised multi-grip pattern.

.10 Aluminum welding: CAN W59.2.

.11 Stainless steel tubing: to ASTM A269, Type 302.

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

.13 Paint: Monorail Beams - epoxy paint system as indicated on structural drawings and in this specification section or approved equivalent in accordance with B7; Color: safety yellow, black (crane beams capacity wording)

.14 Monorail crane beam trolley: Main floor crane beam and sub-level 2 crane beam: OZ1PBT by OZ Lifting Products (1 per each crane beam, 1 tonne capacity).

2.2 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 noted.

.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 Remove and grind smooth burrs, filings, sharp protrusions and projections from metal fabrications to prevent possible injury.

.7 Angle frames shall be of the same material as the cover plate (except for existing frames designated on the drawings for re-use), and cover plates shall be hinged and be supplied with lifting handles, as shown on the drawings. Exterior covers shall be supplied with a hasp for a padlock.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating six hundred (600) g/m2 to CAN/CSA-G164.

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

.3 Zinc primer: zinc rich, ready mix.

.4 Galvanized Steel (monorail support beams)

.1 Remove oil or soap film with detergent or emulsion cleaner.

.2 Lightly abrasive blast with a fine abrasive in accordance with SSPC SP-16 guidelines to achieve a profile of 40 - 75 µm (1.5 - 3.0 mils). When light abrasive blasting is not possible, galvanizing can be treated with a suitable zinc phosphate conversion coating.

.3 Apply one base coat of Amerlock 2 Epoxy paint, 75-125 µm (3.0 - 5.0 mils). Colour: Safety Yellow.

.4 Apply one finish coat of Durethane, 75-125 µm (3.0 - 5.0 mils). Colour: Safety Yellow.

.5 For crane capacity wording, apply two coats of Amerlock 2 Epoxy paint, 100 µm per coat dry film thickness. Colour: black. Select font size and location to be in conspicuous space.

2.4 ISOLATION COATING

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

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

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 ACCESS LADDERS

.1 Construct to PIP STE05501

.2 Ladder to wet well is to exclude a cage and be constructed of 304 Stainless Steel with stainless steel anchors.

.3 Ladder in bypass chamber to exclude a cage and be constructed of 304 Stainless Steel with stainless steel anchors.

2.6 STAIRS

.1 Stairs sizes and framings as indicated on Drawings.

.2 Galvanize all members after fabrication.

.3 Bolt sections together in field.

2.7 ACCESS COVERS

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

.2 Aluminum plates shall have an approved raised 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.

.3 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.

2.8 PIPE BOLLARDS

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

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

2.9 GUARDRAILS, HANDRAILS AND GATES

.1 Steel pipe: diameter as indicated, hot-dip galvanized after fabrication.

.2 Fabricate and install pipe rails to be removable as indicated on Drawings. Sleeve to be secured in concrete slab.

.3 Fully assembled gate shall be capable of swinging in either direction by inverting installation position. Gate size shall be laterally adjusted from minus 32 mm (1-1/4 inch) to plus 64 mm (2-1/2 inch).

.4 Approved Product: GuardDog Self-Closing Safety Gate

.1 Standards: System shall have top and mid rail in accordance with OSHA Standards - 29 CFR 1910.29 (b)(1)(2)

.2 Width: As indicated on Drawings.

.3 Height:

.1 Top Rail: 1067 mm (42 inches), minimum.

.2 Bottom Rail: 533 mm (21 inches).

.4 Hardware: Provide the following:

.1 Gate Hardware: U-Bolts.

.2 Universal Hinge Assembly: Fits railing types up to 51 mm (2 inches) O.D. or flat surface mounting.

.3 Railing adapter kit.

.4 Self-Closing Springs: Two stainless steel torsion springs.

.5 Material: Mild steel, hot-dip galvanized with powder-coated finish.

Part 3 Execution

3.1 ERECTION - GENERAL

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

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

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

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

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

.6 Make field connections with bolts to CSA S1, or weld.

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

.8 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.

.9 Install suitable trolleys on all monorail crane beams and ensure their proper and safe operation.

.10 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250g/L to GS-11.

3.2 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.

3.3 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

1. GENERAL

1.1 RELATED SECTIONS

.1 Bituminous Membrane Roofing: Section 07 50 50
.2 Modified Bituminous Membrane Roofing: Section 07 55 00

1.2 REFERENCE DOCUMENTS

.1 CSA O80 Series – 97, Wood Preservation.

.2 CSA O121 - M1978 (R1998), Douglas Fir Plywood.

.3 CAN/CSA O141 - 91 (R1999), Softwood Lumber.

.4 CSA O151 - M1978 (R1998), Canadian Softwood Plywood

.5 CSA O153 – M1980 (R1998), Poplar Plywood

.6 CSA O437 Series – 93, Standards on OSB and Waferboard

.7 National Lumber Grading Authority (NGLA), Standard Grading Rules for Canadian Lumber, Latest edition.

1.3 REGULATORY REQUIREMENTS

.1 Comply with applicable requirements of Alberta Building Code (ABC).

1.4 SOURCE QUALITY CONTROL

.1 Supply lumber graded by an agency certified by Canadian Lumber Standards Administrative Board.

.2 Supply lumber and panel products marked with a recognized, visible grade stamp.

1.5 PRODUCT DELIVERY AND STORAGE

.1 Protect materials from weather upon delivery to job site.

.2 Store materials on raised supports. Cover materials with waterproof covering. Provide adequate air circulation and ventilation.

.3 Do not store seasoned materials in wet or damp areas.

2. PRODUCTS

2.1 LUMBER

.1 Dimension board lumber: to CAN/CSA 0141-91 and graded in accordance with current National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber.

.1 Moisture Content: maximum 19% at time of installation.
.2 Surface Finish: S4S for members receiving finishes, S2S or S4S for members not receiving finishes.

2.2 PANEL PRODUCTS

.1 Canadian Softwood Plywood: to CSA 0151.

.2 Douglas Fir Plywood: to CSA 0121.

.3 Poplar Plywood: to CSA 0153, standard construction.

.4 Oriented Strand Board: to CSA 0437.0.

2.3 FASTENING DEVICES AND HARDWARE

.1 Nails and Spikes:

.1 Use common spiral nails and spiral spikes except where indicated otherwise.
.2 Use hot dip galvanized finished steel for exposed exterior work, highly humid interior areas and for pressure - preservative and fire-retardant treated lumber.

.2 Bolt, nut, washer, screw and pin type fasteners: hot dip galvanized finish to CSA G164-M92.

.3 Joist hangers: minimum 1.0 mm sheet steel, galvanized.

2.4 ANCILLARY MATERIALS

.1 Surface applied wood preservative: copper napthanate base or pentachlorophene, prepared in accordance with CSA O80.15, coloured green.

.2 Sealing Tape: minimum 60 mm width, polypropylene sheathing tape with acrylic adhesive, or duct tape of same width.

2.5 PRESSURE PRESERVATIVE TREATED WOOD

.1 Pressure Preservative Treated Wood: in accordance with CSA O80 Series.

.1 CSA O80.15 using ACA or CCA water borne preservative treatment for wood construction as listed.

.2 Water-borne preservative treated wood shall have maximum moisture content of 19% after treatment.

3. EXECUTION

3.1 APPLICATION OF SURFACE APPLIED WOOD PRESERVATIVE

.1 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of surface applied wood preservative before installation.

3.2 ERECTION OF FRAMING MEMBERS

.1 Install members true to line, levels and elevations. Space uniformly.

.2 Construct continuous members from pieces of longest practicable length.

.3 Install spanning members with "crown-edge" up.

.4 Install blocking to facilitate installation of finishing materials, fixtures, specialty items and trim.

3.3 CARPENTRY IN CONNECTION WITH ROOFING

.1 Construct wood curbs for roof mounted equipment, anchors and for roof penetrations, except drains.

.1 Curb heights measured from finished roof membrane.

.1 200 mm for plumbing vents.
.2 250 mm for other curbs.

.2 Mechanically fasten plywood facing to parapets, and walls at roof-wall/parapet junctions.

.3 Screw top 38 x 89 mm plates of building control joint box to plywood sides. For roofing control joint box use nails. Leave 25 mm gap between top plate ends every 2.4 m.

.4 Support edges of plywood backslope sheets. Bevel edge of sheets that meet structural deck.

.5 Attach curbs, control joint boxes, blocking and framing directly to structure.

3.4 SCHEDULE OF DIMENSION LUMBER

Description	Species	Grade
Non-structural wall components	Spruce-Pine-Fir	Construction
Structural wall components	Spruce-Pine-Fir	Construction

3.5 SCHEDULE OF PANEL PRODUCTS

Location/Panel Type	Thickness	Grade	Type	Edge
Roof and Exterior Wall Sheathing				
Canadian Softwood Plywood	11 mm	Sheathing		Square
Oriented Strand Board	11 mm	O-1 O-2	O	Square

Note: Where more than one panel type is specified for a single location, provide any one of the types specified for that location.

3.6 SCHEDULE OF PRESSURE PRESERVATIVE TREATED WOOD

.1 Use pressure preservative treated wood for following components:

.1 Wood Cants.
.2 Fascia backing.
.3 Roof Curbs.
.4 Roof Nailers.
.5 Sleepers on roof deck.
.6 Wood in direct contact with concrete or masonry.
.7 Wood in direct contact with soil materials.
.8 Future solar panel supports.

.2 Before installation, provide liberal brush application of surface applied wood preservative to surfaces of pressure preservative treated wood exposed by cutting, trimming or boring.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 – Concrete Unit Masonry

.2 Section 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S604-2012, Standard for Factory-Built Type A Chimneys.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.3 ASTM

.1 ASTM E 96/E 96M-13, Standard Test Methods for Water Vapour Transmission of Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for board insulation and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two (2) copies of WHMIS SDS in accordance with Section 01 35 29.06- Health and Safety Requirements.

.3 Indicate VOC's during application and curing.

.3 Quality Assurance Submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.6 AMBIENT CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.7 SEQUENCING

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

Part 2 Products

2.1 INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701

.1 Type: 4.

.2 Compressive strength: 25 psi

.3 Thickness: as indicated.

.4 Size: Largest practical size available for application.

.5 Edges: square.

2.2 ACCESSORIES

.1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

3.3 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for board insulation application 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 the Contract Administrator.

3.4 INSTALLATION

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

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

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 type A chimneys and CSA B149.1 and CSA B149.2 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

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

.7 Do not enclose insulation until it has been inspected and approved by the Contract Administrator.

3.5 RIGID INSULATION INSTALLATION

.1 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.

3.6 PERIMETER INSULATION

.1 Exterior application: extend boards below finish grade as indicated. Install on exterior face of perimeter foundation wall with adhesive.

.2 Exterior application: extend boards 1200 mm from perimeter foundation walls. Slope boards away from foundation on compacted fill.

3.7 CAVITY WALL INSTALLATION

.1 Install extruded polystyrene insulation boards on outer surface of inner wythe of wall cavity over impaling clips.

.2 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150mm wide modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.8 CLEANING

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

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.9 PROTECTION OF WORK

.1 Protect finished work in accordance with manufacturer’s recommendations.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 21 016 – Blanket Insulation.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

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

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06- Health and Safety Requirements.

.3 Certificates:

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

1.4 QUALITY ASSURANCE

.1 Mock-Ups:

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

.2 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.

.3 Mock-up will be used to judge quality of work, substrate preparation, and material application.

.4 Locate where indicated.

.5 Allow 24 hours for inspection of mock-up by Contract Administrator before proceeding with vapour barrier work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Remove mock-up and dispose of materials when no longer required.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, six (6) mil (0.15 millimetres) thick.

2.2 LIQUID AIR BARRIER MEMBRANES (WALL SURFACE

.1 Liquid air/vapour barrier (thick system type): Air-Bloc 32 as manufactured by Bakor, a one (1) component elastomeric bitumen, trowel or spray applied to a wet film thickness of 0.118" (three (3) millimetres) or the Contract Administrator approved equal.

2.3 TRANSITION MEMBRANE AND BASE FLASHING

.1 Transition membrane to span gaps between dissimilar surfaces in key areas such as wall-to-window frames, wall-to-slab, wall-to-roof junction, base flashings at masonry walls, flashings at stone sills and joints between dissimilar materials etc.): Bakor Blueskin SA, one (1.0) millimetres thick, self-adhered EPDM membrane flashing.

2.4 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, cloth fabric duct tape type recommended by vapour barrier manufacturer, two (2) inches (fifty (50) millimetres) wide for lap joints and perimeter seals, one (1) inch (twenty-five (25) millimetres) wide elsewhere.

.2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

.3 Staples: minimum ¼ inch (six (6) millimetres) 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 Sheet Vapour Barrier:

- .1 Ensure services are installed and inspected prior to installation of retarder;
- .2 Install sheet vapour retarder on warm side of exterior wall assemblies to form continuous retarder;
- .3 Use sheets of largest practical size to minimize joints; and
- .4 Inspect for continuity. Repair punctures and tears with sealing tape before Work is concealed.

.2 Transition Membranes:

- .1 Verify that surfaces and conditions are ready to accept the Work of this section. Notify Contract Administrator in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrate
- .2 Apply in accordance with manufacturer's written instructions and stipulated environmental conditions;
- .3 Overlap and seal to adjacent surfaces for continuous gap free installation; and
- .4 Do not conceal with new construction until inspected.

3.2 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.

3.3 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.

3.4 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

- .1 Install moulded box vapour barrier Wrap boxes with film sheet providing minimum twelve (12) inches (three hundred (300) millimetres) perimeter lap flange; and

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.5 CLEANING

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

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: separate waste materials for recycling in accordance with Section 74 19- Waste Management and Disposal.

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

END OF SECTION

1. GENERAL

1.1 INTENT

.1 Provide flexible sheet membrane:

.1 continuously adhered to wall substrates, bridging joints and gaps,

.2 continuously adhered to deck substrates of ceilings, bridging joints and gaps,

.3 installed to permit an effective seal at window frames, door frames, and other components fitted into openings in building envelope, and,

.4 sealed to pipes, ducts, conduits, masonry connectors and other items penetrating the building envelope.

.2 The intent is to provide a continuous barrier to air movement and an effective barrier to vapour transmission through the building envelope.

1.2 RELATED SECTIONS

.1 Sealants: Section 07 92 00.

1.3 SUBMITTALS

.1 Comply with requirements of Division 1.

.2 Submit product data illustrating membranes and accessory materials and indicating compliance with specified requirements.

.3 Submit statement from manufacturer(s), indicating products supplied under this Section are compatible with one another and with products previously installed under the work of related Sections.

.4 Provide duplicate 200 mm x 200 mm samples of membrane adhered to all project substrates, including adjoining membranes specified in other Sections.

1.4 INSPECTION BY THE CITY

.1 Provide reasonable notice to the City to allow inspection of completed installation prior to concealing work of this Section.

1.5 SITE CONDITIONS

.1 Apply materials under environmental conditions recommended by manufacturer.

.2 Ensure substrates temperatures and ambient air temperatures are within range recommended by membrane manufacturer. Provide hoarding and temporary heating if required.

1.6 COORDINATION

.1 Select products to be compatible with adjoining membranes previously installed under related Sections.

.2 Select products from a single manufacturer, or products which are compatible, from different manufacturers.

1.7 SEQUENCING AND SCHEDULING

.1 If climatic conditions may result in condensation between membranes and substrates, schedule installation of insulation to immediately follow installation of membranes.

.2 Install membranes over joints and gaps before installing membranes over adjacent substrates.

.3 Unless membrane will be adhered directly to window frames or other components fitted into openings, install membrane before installation of such components.

2. PRODUCTS

2.1 SHEET MEMBRANE

.1 Approved product: W.R. Meadows AIR-SHIELD or approved alternate.

.2 Method of Adhesion: self-adhering to primed surface.

2.2 JOINT MEMBRANE

.1 Material, Method of Adhesion, and Performance: same as Sheet Membrane, except elongation at break, compatible with Sheet Membrane.

2.3 ACCESSORY MATERIALS

.1 Primers, Surface Conditioners and Mastic: as recommended by membrane manufacturer, compatible with substrates, including, but not limited to, the following:

.1 Metal substrates.
.2 Concrete which may contain form release agents.
.3 Wood substrates to which preservative or fire retardant treatment has been applied.

.2 Approved products

.1 Primer: W.R. Meadows MEL-PRIME or approved alternate.

3. EXECUTION

3.1 EXAMINATION AND PREPARATION

.1 Verify substrate conditions are acceptable before starting installation of membranes.

.2 Prepare substrate surfaces in accordance with membrane manufacturer's printed recommendations.

.3 Apply primer to substrates to receive membranes, in accordance with manufacturer's recommendations.

3.2 INSTALLATION, GENERALLY

.1 Install membranes in accordance with membrane manufacturer's recommendations, and to ensure continuity of air and vapour seal. Neatly trim membrane terminations.

.2 Lap horizontal membrane joints to shed water to exterior.

.3 Install Sheet Membrane over Joint Membrane installed over joints and gaps.

.5 The following are unacceptable:

.1 Fishmouths and folds.
.2 Blisters and bulges.
.3 Insufficient overlaps.
.4 Inadequate adhesion.
.5 Punctures, tears, cuts.
.6 Other similar defects.

3.3 INSTALLATION OVER JOINTS AND GAPS

.1 Install Joint Membrane, minimum 250 mm wide, centered over joints and gaps.

.2 Lap ends of Joint Membranes minimum 150 mm.

.3 Do not loop Joint Membranes into joints.

3.4 INSTALLATION ON WALLS

.1 Install Sheet Membrane on walls.

3.5 INSTALLATION AT PENETRATIONS

.1 Cut membrane to ensure it is installed tight to penetrations.

.2 Provide flanged membrane collar around mechanical and electrical penetrations. Flange shall be at plane of surrounding membrane.

.3 Apply mastic where membrane has been cut to fit around penetrations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Latex modified concrete facing, bonded to rigid polystyrene foam insulation backing, for exterior application to low rise, and perimeter foundation walls, with related flashings and accessory components.

1.2 RELATED SECTIONS

.1 Section 07 62 00 - Metal Flashing And Trim.

1.3 REFERENCES

.1 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701, Standard for Thermal Insulations, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

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

.1 ASTM A123/A123M, Zinc (Hot Dip Galvanized) Coatings on Iron or Steel Products.

.2 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.3 ASTM D1621, Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.

.4 ASTM D2842, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.5 ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials.

.6 ASTM D696, Standard Test Method for Determining Coefficient of Linear Thermal Expansion of Plastics between -30C and +30C.

.7 ASTM C203,Standard Test Method for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.

.8 ASTM D2126, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

.3 Canada Green Building Council (CaGBC)

.1 LEED® Canada For New Construction and Major Renovations 2009 and LEED® Canada for Core and Shell Development 2009 Rating System.

.4 Canadian Standards Association

.1 CSA S478-95 (R2007) – Guideline on Durability in Buildings.

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

.1 Visit www.tech-crete.com for a current copy of the Material Safety Data Sheet (MSDS)

.6 Canadian Construction Materials Centre (CCMC) Evaluation Listing, published by the Institute for Research in Construction (IRC) of the National Research Center Canada (NRC/CNRC):

.1 Evaluation Listing CCMC 04888-L for STYROFOAM™ Tech-Crete Blanks

1.4 SYSTEM DESCRIPTION

.1 Assembly of components includes purpose supplied, preformed panel mounting clips capable of securing factory bonded concrete faced insulated wall panels to structural supporting wall framing.

.2 Comply with requirements for continuity of building air barriers, vapour retarders plus wind and suction loads as identified in the National Building Code and applicable local requirements.

1.5 SUBMITTALS FOR REVIEW

.1 Submission procedures as specified in Division 1

.2 Shop Drawings: Indicate dimensions, layout, construction and expansion joints, construction details, methods of anchorage.

.3 Samples: Submit two (2) samples of full size wall siding, 200 x 200 mm (8 x 8 inch) in size illustrating manner of fitment devices with adjacent panels, with specified finishes and surface texture.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Transport, handle, store, and protect delivered products as specified in Section 01 61 00.

.2 Store concrete faced insulated wall panels under cover, and in original packaging until ready to install. Store opened packages under cover until installed. Schedule installation to minimize open package time

.3 Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation.

.4 Prevent contact with materials which may cause electrolysis, discolouration or staining.

1.7 WARRANTY

.1 Provide warranties as specified in Division 1:

.2 Provide manufacturers five (5) year limited warranty to include panel replacement for delamination of concrete facing.

Part 2 Products

2.1 MANUFACTURERS

.1 Tech-Crete Processors Ltd., CFI®Wall Panel, in modular sections, website: www.tech-crete.com, Telephone: 250-832-9705

.2 Substitutions: Product of equal quality and function approved by Engineer

2.2 WALL PANEL ATTACHMENT

.1 Galvanized Steel: ASTM A123/A123M-08 - Zinc-Coated (Galvanized), Z275 to G90 coating designation, preformed as supplied by manufacturer, complete with corrosion proof masonry fasteners.

2.3 INSULATION

.1 STYROFOAM™ Tech-Crete Blanks by DOW Chemical, extruded polystyrene, conforming to code requirements, in accordance with CAN/ULC S701 type 4.

.2 Thermal resistance: RSI 0.87/25mm to ASTM C518.

.3 Foam Compressive Strength: 240 kPa (35 PSI) in accordance with ASTM D1621.

.4 Water Absorption: ASTM D2842: <0.7 % by volume.

.5 Water Vapour Permeance: 0.8 perms in accordance with ASTM E96.

.6 Insulation Thickness: 102 mm.

2.4 CONCRETE FACED INSULATED WALL PANELS

.1 Concrete: Latex modified concrete mix, 8 mm (5/16”) thick, with control joint score at mid-length.

.2 Edge Treatment: Tongue and groove along longitudinal foam edges, butt joints on lateral edges.

.3 Surface Finish: Textured Broom finish; Grey colour, may be coated.

2.5 ACCESSORIES

.1 Gaskets to Adjacent Substrates: Standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; colour to match adjacent colour.

.2 Sealants to Adjacent Substrates: Standard type suitable for use with installation of system; non-staining, non-skinning, non-shrinking and non-sagging; ultraviolet and ozone resistant; colour as selected.

.3 Clips and Fasteners: Manufacturer's standard type to suit application; as supplied.

.4 Field Repair and Touch-up: As recommended by panel manufacturer.

.5 Wall panel coloured coating (if required): Exterior grade, latex based, concrete or masonry paint or stain.

.6 Perimeter Insulation Flashings 24 gauge minimum: Coordinate supply of end closures and flashings for perimeter insulation system with Engineer

2.6 COMPONENTS

.1 Exterior concrete faced insulated wall panel sizes:

.1 Width: 610 mm (24 inches).
.2 Length: 1220 mm (48 inches).
.3 Thickness: 100 mm (4 inches)

.2 Internal and External Corners:

.1 Manufacturers installation guidelines provide corner details
.2 Metal profiles to suit assembly, brake formed to required profiles
.3 Trim, Closure Pieces, Caps, Flashings, Facias, Soffits and Infills: Brake formed to required profiles.

2.7 FABRICATION

.1 Form sections true to shape, accurate in size, square, and free from distortion or defects.

.2 Form custom pieces in longest practicable lengths.

.3 Fabricate corners in one continuous piece.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions and substrates before starting work.

.2 Verify that building framing members are ready to receive panel assembly.

.3 Remove substrate surface irregularities before installing wall panels. Sweep and clear debris clear of surfaces to receive panels.

.4 Ensure existing membrane substrate is cured and dry.

.5 If the lowest substrate surface is not level to receive panels, create a level surface with a galvanized steel ledger angle, and secure level.

3.2 INSTALLATION

.1 Weather lap barriers, stagger vertical joints of each course. Repair incidental tears.

.2 Seal securely to achieve air and moisture tightness.

.3 Ensure snug fit between panel tongue and grooves, and lateral butt joints.

.4 Fasten concrete faced insulated panels to structural supports; aligned level and plumb.

.5 Install panels with vertical joints and panel control joints in alignment.

.6 Use manufacturer’s fasteners. Maintain neat appearance.

.7 Cover exposed insulation at corners and top of perimeter insulation with prefinished flashing as specified in Section 07 62 00.

.8 Where concrete flatwork or asphalt is to be laid adjacent to CFI Wall Panels, an isolation joint should be provided to protect the CFI mortar surface from differential movement

END OF SECTION

1. General

1.1 INTENT

.1 This Section specifies requirements common to bituminous membrane roofing work. Read in conjunction with the following related Sections:

.1	Modified Bituminous Membrane Roofing:	Section 07 55 00.
.2	Metal Flashings for Bituminous Membrane Roofing:	Section 07 62 20.

1.2 RELATED SECTIONS

.1 Wood blocking, curbs, control joint boxes, backslopes, nailers and cant strips: Section 06 10 00.

1.3 REFERENCE DOCUMENTS

.1 Except where specified otherwise, meet or exceed the Alberta Roofing Contractors Association Ltd. (ARCA) requirements for the Five-Year Certificate of Assurance. These requirements are published in the ARCA "Manual on Good Roofing Practice and Accepted Roofing Systems", current edition. This is notwithstanding that not more than a two-year extended warranty is specified in this Section.

.2 For definitions of roofing related terms used in these specifications, refer to Glossary of Roofing Terms contained in the ARCA manual.

1.4 DESCRIPTION OF EXISTING SYSTEMS

.1 Roof 1:
- .1 Concrete deck.
- .2 Sloped concrete topping.
- .3 Vapour retarder
- .4 100 rigid insulation
- .5 Built-up roofing.

.2 Roof 2, 3, and 4:
- .1 Metal deck
- .2 Sloped concrete topping.
- .3 Vapour retarder
- .4 100 rigid insulation
- .5 Built-up roofing.

1.5 DESCRIPTION OF NEW SYSTEMS

.1 Roof 1, 2, 3, and 4: Provide roofing assembly on sloped concrete topping consisting of:

.1 Vapour retarder.
.2 Insulation.
.3 Insulation Blocking.
.4 Insulation Cover Panels.
.5 2 ply modified bituminous membrane.
.6 Accessories.

1.6 SHOP DRAWINGS

.1 Comply with requirements of Division 1. Clearly indicate, with large scale details, flashings and control joints, plus details of the roofing which may be considered by the Contract Administrator as special.

.2 For slopes 2:12 and greater, provide a plan layout of insulation cover sheathing fastener locations. Attach comparable Factory Mutual tested assembly fastener description and layout.

1.7 PROJECT RECORD DOCUMENTS

.1 Comply with requirements of Division 1.

.2 Include following information on project record documents:

.1 Date of completion of the roof membrane.

.2 List of materials, by manufacturer's product name, used in the roof assembly.

.3 Provide schematic roof plan on 8 1/2 x 11 drawing. Indicate changes from Contract drawings. Supplement with letter size detail drawings if applicable.

1.8 MAINTENANCE DATA

.1 Comply with requirements of Division 1.

.2 Submit maintenance data indicating frequency and type of maintenance required, including protection from damage.

1.9 INSTALLER QUALIFICATIONS

.1 The foreman and at least one other roofer shall hold a three-year Apprenticeship Certificate or a Journeyman Certificate.

.2 The rest of the roofing crew shall have at least partly completed the roofer apprenticeship program and shall have submitted application to the appropriate provincial authority for certification as "Roofer".

.3 Torch-applicators shall be certified by membrane manufacturer.

1.10 TESTING AND INSPECTION

.1 Inspection of the work of this Section will be performed and paid for by the City.

.2 Notify the City of commencement of the work and provide a schedule of roofing work.

.3 Accompany the Contract Administrator during inspections.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials, handle and store in original packages and containers with manufacturer's seals and labels intact. The manufacturer's name, brand, mass, specification number and lot number shall be shown on the labels.

.2 Do not store materials on the roof in concentrations which exceed design live loads.

1.12 COORDINATION

.1 Coordinate work of this Section with the following:

.1 Membranes connecting to roofing membranes.
.2 Construction of roof perimeters and penetrations.
.3 Plumbing vents and drains.
.4 Metal cladding matching colour of roof flashing.

1.13 EXTENDED WARRANTY

.1 Provide an extended warranty stating:

.1 that the roofing system has been constructed in accordance with the Contract Documents, and

.2 that the Contractor shall, at no additional expense to the City, repair any actual leaks or deficiencies in the roofing system, occurring within two years after the date of Interim Acceptance of the Work, and which have resulted from faulty or improper workmanship.

.2 For the purpose of this extended warranty, the roofing system includes the roofing assembly and related sheet metal work.

.3 Contract Administrator will inspect the roofing system in the last three months of extended warranty period and will promptly inform Contractor of deficiencies.

.4 Stop leaks which have resulted from a deficiency, within a time reasonably determined by the Contract Administrator.

.5 Correct deficiencies within 15 working days of notification by the Contract Administrator, or as otherwise determined by the Contract Administrator.

1.14 SECURITY FOR EXTENDED WARRANTY

.1 If roofing system has been constructed by a member of the ARCA, Contractor shall obtain, on behalf of the Contract Administrator, the ARCA Two Year or Five-Year Certificate of Assurance, at Contractor's option, for the performance of Contractor's obligations under the extended warranty. The Contract Administrator will not accept other roofing certificates.

.2 If the roofing system has been constructed by a non-member of ARCA, Contractor shall obtain a maintenance bond for the performance of Contractor's obligations under the extended warranty. Maintenance bond shall be:

.1 in the amount of 100% of the cost of materials and labour associated with the roofing and roofing related work performed under this Contract.

.2 in a form acceptable to the Contract Administrator and consigned to the City of Winnipeg.

.3 Submit Certificate of Assurance or Maintenance Bond prior to Interim Acceptance of the Work.

2. Products

2.1 PRODUCTS, GENERALLY

.1 Except as specified otherwise, provide products to ARCA requirements.

.2 Sealing Compound: rubber-asphalt, to CAN/CGSB-37.29-M89.

2.2 INSULATION

.1 Provide one of the following, at Contractor's option:

.1 Molded Expanded Polystyrene (MEPS) Board: certified for conformance with CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering, Type 2, and as follows:

.1 Thermal Conductivity (kSI): 0.036 W/m°C maximum.
.2 Board Size, Nominal: 610 mm x 1220 mm.
.3 Dimensional Stability: 0.3% max. linear change.

.4 Certification: third party, in accordance with CGSB, ULC, or other certification programs accredited by the Standards Council of Canada.

.2 Glass Fibre Board: to CAN/CGSB-51.20-M87, top face surfaced with heavy kraft paper/asphalt layer bonded to the glass fibre board, and as follows:

.1 Thermal Conductivity (kSI): 0.041 W/m°C maximum.
.2 Board Size, Nominal: 900 mm x 1200 mm.

.2 Provide insulation for single layer installation.

.3 Provide insulation thickness as follows:

.1 MEPS, Uniform Thickness: 63.5 mm.
.3 Glass Fibre Board, Uniform Thickness: 75.0 mm.

.4 Insulation Blocking: pine or spruce to CAN/CSA-O141-91, construction grade, maximum 15% moisture content at time of installation, sized to match total thickness of insulation.

2.3 INSULATION COVER SHEATHING

.1 As Substrate for Mop Application: one of the following, at Contractor's option:

.1 Wood Fibreboard: to ARCA manual.
.2 Perlite-based Thermal Insulation Board: to ASTM C728-91.

.2 As Substrate for Nail Application: one of the following, at Contractor's option, 16 mm thick, with tongue & groove edges:

.1 Canadian Softwood Plywood: to CSA O151-M1978.
.2 Douglas Fir Plywood: to CSA O121-M1978.
.3 Waferboard or Oriented Strand Board (OSB): to CAN/CSA-O437.0-94, top face non-waxed.

2.4 CANT STRIPS

.1 Profile: 100 mm high x 100 mm wide, 45-degree slope. Angle cut to fit tightly on back and bottom, where roof to wall angle varies from 90 deg.

.2 As Substrate for Mop Application: one of the following, at Contractor's option:

.1 Fibreboard: material same as wood fibreboard insulation.

.2 Perlite-based: perlite thermal insulation board to ASTM C728-91.

.3 Wood: pine or spruce to CAN/CSA-O141-91, construction grade, maximum 15% moisture content at time of installation.

.3 As Substrate for Nail or Torch Application: wood.

2.5 FLEXIBLE FLASHING AND AIR SEAL MEMBRANE

.1 Provide minimum 2.5 mm thick, SBS modified bitumen premanufactured sheet, with manufacturer's standard internal reinforcement, compatible with substrates and adjoining membranes.

2.6 AUXILIARY LEVELLING SURFACES

.1 Not used.

2.7 ACCESSORIES

.1 Roofing Nails: #10, hot dipped zinc galvanized, with 12 mm diameter heads.

.2 Gypsum Sheathing Screws: Not used.

.3 Tape: Not used.

.4 Fasteners: to Factory Mutual 4450, 1989 edition. Fasteners through membrane shall meet requirements of Factory Mutual 4450, Appendix E. Fasteners through membrane, FM-90 coated 43 mm (1.7 inch) Dekfast/ES Fasteners, or Siplast NVS Fasteners, or Dekfast 63 mm (2 ½ inch) DEKLITE (drilled and screwed) Fasteners.

.5 Fastener Discs: sheet steel, hot dip galvanized, minimum 75 mm diameter for field membrane securement and 25mm for OSB/plywood panel installation.

.6 MBM fire tape as per Manufacturer’s instructions.

3. Execution

3.1 VERIFICATION OF CONDITIONS

.1 Examine all surfaces to receive work of this Section. Notify the Contract Administrator of unacceptable surfaces.

.2 Verify that all roof openings, except roof drains and self-flashing plumbing vents, are curbed, as follows:

.1 Mounted on and attached directly to structural deck.
.2 Curb Height: 200 mm, measured from top of membrane.

.3 Verify that roof drains are installed at proper elevation relative to finished roof surface.

.4 Verify that control joints, and plywood and lumber nailer plates to walls and parapets are located and installed as detailed.

.5 Verify that cladding anchors are minimum 300 mm above finished roof membrane.

3.2 PROTECTION OF EXISTING WORK AND POLLUTION CONTROL

.1 Protect surrounding surfaces against damage from roofing work.

.2 Place plywood runways over the work for the movement of materials and other traffic during roofing installation.

.3 Where hoisting is necessary, hang tarpaulins to protect walls during delivery of hot asphalt from ground to roof.

.4 Location of kettle and tanker is subject to approval by the Contract Administrator. Locate kettles and tankers:

.1 Away from building air inlets.
.2 To minimize bitumen odour to nearby occupied buildings.
.3 Away from building openings.
.4 So that smoke will not discolour building finishes.

3.3 FIRE SAFETY

.1 Inform the Contract Administrator of unforeseen fire hazards and obtain instructions before proceeding or continuing with torch application.

.2 Keep suitable fire extinguishers within 10 metres of each torch in use and at kettles and tankers in use.

.3 Do not use torches near roof-mounted air intakes, wall cladding, combustible building paper and combustible finishes.

.4 Take additional precautions against fire as needed to provide adequate fire safety.

3.4 INSTALLATION, GENERALLY

.1 Tape joints of sheathing as required to prevent asphalt dripping through structural decks.

.2 Install materials to manufacturers' printed recommendations.

.3 Whenever practicable, complete sections of roofing on same day started.

.4 Perform moisture checks using an electronic moisture meter if work underway has become wet. Do not continue roofing until the moisture content is reduced to levels acceptable to the Contract Administrator.

.5 Equip kettles with thermometers. Provide portable thermometer to check the thermometer attached to kettle and asphalt application temperatures.

.6 Keep kettles at least one-half full during working period. Add cold bitumen in small quantities. Stir contents of kettles frequently to prevent localized overheating.

.7 Maintain one qualified tradesman at the heating kettle at all times of operation.

.8 Apply sheet materials for continuous fusion of sheets and adhesion to substrates, with no ridges, blisters, buckles, wrinkles, or voids.

.9 Apply separator sheet to uninsulated wood deck, to ARCA manual.

3.5 INSTALLATION OF AUXILIARY LEVELLING SURFACES

.1 Not used.

3.6 INSTALLATION OF VAPOUR RETARDER ON WOOD DECK

.1 Not used.

3.7 INSTALLATION OF VAPOUR RETARDER ON GYPSUM SHEATHING

.1 Not used.

3.8 INSTALLATION OF VAPOUR RETARDER ON CONCRETE DECK

.1 Apply 2 plies #15 organic felts, one mechanically fastened, one mopped.

3.9 FLEXIBLE FLASHING AND AIR SEAL MEMBRANE INSTALLATION

.1 Not used.

3.10 ASPHALT APPLICATION

.1 Check asphalt temperature regularly to avoid exceeding its final blowing temperature.

.2 Cool hot asphalt to between 95-120 degrees Celsius before contact with MEPS insulation. Check temperature with thermometer acceptable to the Contract Administrator.

.3 Apply asphalt types as follows:

.1 Type 2: slopes less than 1:12.
.2 Type 3: slopes 1:12 and greater.

.4 Hand mop to embed felts on slopes 1:12 and greater.

3.11 INSTALLATION OF WATER CUT-OFFS

.1 Install temporary water cut-offs to all insulation edges exposed at the end of each day's work.

.2 Construct permanent water cut-offs by end wrapping edge of insulation with a mopped single ply of organic felt.

.3 Provide permanent water cut-offs at roof area perimeters and at curbs.

3.12 INSTALLATION OF INSULATION

.1 Apply 1.2 kg/m^2 coat of hot asphalt to top of vapour retarder assembly and embed insulation boards. Align board edges each way.

.2 Ensure full adhesion. Fill insulation joints over 10 mm wide with insulation.

.3 Trim insulation neatly at roof drains to just slightly greater than diameter of drain sleeves or drain bodies, whichever is applicable.

3.13 INSTALLATION ON SLOPES 1:12 AND GREATER

.1 Install insulation blocking to ARCA requirements and as specified.

.2 Set insulation blocking in sealing compound on vapour retarder assembly and mechanically fasten to deck using fasteners. Recess fastener heads.

.3 For slopes up to, but not including, 2:12, mechanically fasten back-mopped insulation cover to insulation blocking, at 300 mm centres.

.4 For slopes at 2:12 and greater, secure insulation cover using wood fasteners and fastener discs, at spacing equal to or closer than tested assembly meeting or exceeding Factory Mutual I-90 Windstorm Classification.

.5 Extend primary membrane of adjoining lower slope roofs at least 1 m up the greater slope roof and fasten to insulation blocking or above cants with roofing nails at 150 mm centres.

3.14 INSTALLATION OF INSULATION COVER SHEATHING AND CANT STRIPS

.1 Install insulation cover sheathing over insulation.

.2 Align long edges of insulation cover sheathing. Offset short edges minimum 150 mm. Offset cover sheathing joints minimum 150 mm from insulation joints.

.3 Slopes up to 2:12: adhere insulation cover sheathing with 1.2 kg/m^2 coating of hot asphalt, backmopped before applying to MEPS insulation.

.4 Slopes 2:12 and Greater: mechanically fasten insulation cover sheathing to structural deck and insulation blocking. Use fasteners with fastener discs. Meet or exceed tested assembly meeting requirements for Factory Mutual I-90 Windstorm Classification.

.5 Install cant strips over insulation cover panels. For mopped applications, embed cant strips firmly by hand into hot asphalt.

.6 Nail wood cant strips at 400 mm o.c., staggered along sloped face, to parapet.

3.15 INSTALLATION AT ROOF DRAINS

.1 Reduce insulation thickness by 13 mm to provide depressed roof areas measuring 2400 mm x 2400 mm, centred over roof drains. Make transition to depressed areas by uniformly sloping insulation over 100-200 mm.

.2 Trim insulation neatly at drain openings to fit around drain sleeves.

.3 Install sleeves, fully embedding flange in plastic cement.

.4 Install primary membrane, cutting neatly around drain flange.

.5 Install lead flashing, centred over drain, and applied over primary roofing membrane, roof drain flange and 25 mm down into drain. Fully embed in plastic cement.

.6 Strip in lead flashing to ARCA recommendations. Use MBM stripping over MBM primary membrane.

.7 Torch 1000 x 1000 mm cap sheet over base sheet stripping and lead flashing, centred over drain. Trim cap sheet stripping flush with inside of clamping ring.

END OF SECTION

1. General

1.1 RELATED SECTIONS

.1 Bituminous Membrane Roofing General Requirements: Section 07 50 50.
.2 Metal Flashings for Bituminous Membrane Roofing: Section 07 62 20.

1.2 DETAIL DRAWINGS

.1 Not used.

2. Products

2.1 PRIMARY MEMBRANE AND MEMBRANE FLASHING

.1 Provide two-ply SBS modified bitumen membrane, including SBS modified bitumen flashings, to manufacturer's recommendations conforming with ARCA accepted specifications, and as specified in this Section.

.2 For membrane component types and reinforcement, refer to Primary Membrane Schedule at end of this Section.

.3 Cap Sheet Finish: colored granules from manufacturer’s standard range. Contractor to ensure that all the cap sheet rolls are from the manufacturer’s same production run to ensure even colour of finished roofing system.

.4 Membrane Flashing Finish: granules in colour selected by the Contract Administrator from manufacturer's standard range.

3. Execution

3.1 INSTALLATION

.1 Install membrane components in accordance with requirements of ARCA Five Year Certificate of Assurance.

.2 Use installation method as indicated on Primary Membrane Schedule at end of this Section.

.3 Torch apply sheet materials for continuous fusion of sheets and adhesion to substrates.

.4 Seal seams of nailed base sheets using cold or hot applied asphalt, or with torch heat application.

.5 Limit cap sheet bleed-out at seams to 12 mm. Cover excessive bleed-out and replace missing mineral surfacing by embedding matching colour granules.

.6 Torch-apply cap sheet and cap sheet flashing.

.7 Primary membrane deficiencies shall include, but not be limited to, ridges, tenting, buckles, wrinkles, and voids.

3.2 PRIMARY MEMBRANE SCHEDULE

Component Substrate	Installation Method	Reinforcement, Minimum, g/m^2
Base sheets on slopes up to 2:12		
Wood fibreboard	Mop	95 glass fibre
Plywood, lumber and OSB	Nail or mop	180 polyester
Base sheet flashing		
All substrates	Self-adhered	180 polyester
Cap sheets		
Base sheet	Torch	180 polyester
Cap sheet flashing		
Base sheet flashing	Torch	180 polyester

END OF SECTION

1. GENERAL

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of the Contract form an integral part of the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 DESCRIPTION

.1 Roofing System:

.1 Cap Sheet: Soprema Sopralene Flam 250 granular or IKO Torchflex TP 250 Cap (torched) use second layer of torched cap sheet for roof membrane protection at downspout drainage locations.
.2 Composite fibreboard: Soprema Soprabase FR 180 Board or Roofcraft 180 Base FR, a composite overlay board with base sheet factory laminated to its surface (25mm) (mopped).
.3 Primary insulation: Polyisocyanurate Rigid Insulation (mopped).
.4 Secondary insulation: Sloped Type 2 Expanded Polystyrene (mopped).
.5 Vapour Barrier: 2 Ply 15# felt (mopped).
.6 Thermal Barrier: 12.7mm Glass mat Gypsum Board (mechanically fastened to FM Class I-90 standards)
.7 Metal deck

1.3 INSTALLER QUALIFICATIONS

.1 The roofing contractor shall be, during the bidding period and during installation, officially recognized as an approved contractor by the roofing materials manufacturer (IKO or Soprema) The roofing contractor shall be an ARCA (Alberta Roofing Contractors Association) approved contractor.

.2 Roofing Work shall be preformed by trained and skilled applicators, employed by a contractor operating all adequate and necessary equipment to execute such work in accordance with the manufacturer's recommendations and recognized standards.

.3 The foreman and at least one other roofer shall hold a three-year Apprenticeship Certificate or a Journeyman Certificate.

.4 The rest of the roofing crew shall have at least partly completed the roofer apprenticeship program, and shall have submitted application to the appropriate provincial authority for the certification as "Roofer".

.5 Maintain one qualified tradesman at the heating kettle at all times of operation.

1.4 RELATED WORK

.1 Installation of metal flashing and accessories.

.2 Carpentry Work.

1.5 MANUFACTURER'S REPRESENTATIVE

.1 Permit and facilitate access to the work site and roofs by manufacturer's representative at all times.

1.6 MATERIALS STORAGE

.1 Deliver and store all materials in their original packaging, displaying the manufacturer's name, quality, weight, standards references and all other indications or references considered as standard.

.2 Adequately protect and store materials at all times in a dry space, properly ventilated and protected from the elements. Only remove materials which are to be used that same day from this storage space. For ease of installation in colder weather, it is suggested that rolls be stored in a heated area at a minimum temperature of +10 C prior to application. If rolls can't be stored in a heated shelter, they could be heated with a torch, prior to installation. FOR PRECISE DESCRIPTION, REFER TO MANUFACTURER'S INSTALLATION TECHNIQUE SECTION FOR EACH TYPE OF MEMBRANE.

.3 Store membrane rolls on end, one pallet high, selvage edge up; do not store in a leaning position.

.4 When loading products on the roof, avoid concentration of weight on one area, which could cause excessive deflection of the roof structure.

1.7 SITE PROTECTION

.1 During roofing work, protect exposed surfaces of finished walls with tarps in order to prevent damage.

1.8 FIRE PROTECTION

.1 Follow safety measures described in the roofing material Manufacturer's Manual as well as ARCA recommendations.

.2 At the end of each work day, use a heat detector gun to spot any smouldering or concealed fire. Ensure workers are still on site at least two hours after torch application.

.3 Never apply the torch directly to old, dry wood surfaces. Follow the fire safety recommendations of the manufacturer and ARCA.

.4 During roofing installation, maintain a clean site and have at least one approved ABC fire extinguisher within 6 meters of each roofing torch. Torches must never be placed near combustible or flammable materials.

.5 Do not rest torches and other hot tools directly on the roof. All hot tools are to be raised off the roof surface with the use of metal stands or other non-combustible devices.

.6 Apply Soprema Fireguard Tape, or other suitable product, to all roof junctions and unprotected joints to prevent heat and flames from the torch from accessing the edges of the combustible substrate.

1.9 SHOP DRAWINGS

.1 Not applicable.

1.10 WARRANTY

.1 Refer to Section 01 33 00 Submittals, 1.17. Guarantees.

1.11 PROJECT RECORD DOCUMENTS

.1 Comply with requirements of Division 1.

.2 Include following information on project record documents:

.1 Date of completion of the roof membrane.

.2 List of materials, by manufacturer's product name, used in the roof assembly.

.3 Provide schematic roof plan on 8 1/2 x 11 drawing. Indicate changes from Contract drawings. Supplement with letter size detail drawings if applicable.

1.12 TESTING AND INSPECTION BY THE CITY

.1 Inspection of work of this Section will be performed and paid for by the City.

.2 Notify the City of commencement of the work and provide a schedule of roofing work.

.3 Accompany the City during inspections.

2. PRODUCTS

2.1 MATERIALS

.1 Gypsum Board: Water repellent surfacing. ASTM C1396M-06a or latest revision, 12.7mm thick.

.2 Vapour Barrier: 2 Ply 15# felt. No substitutions.

.3 Asphalt: Type III CSA A123.4 M Standard.

.4 Primary Insulation: Polyisocyanurate rigid insulation. CAN/ULC-5704-03, or latest

revision, Const. No. C34 R24 (2 lifts X 50mm), RSI 2.677.

.5 Secondary (Sloped) Insulation: Type 2, expanded polystyrene, 13mm minimal thickness. CAN/CGSB-51.20-M87, or latest revision.

.6 Fibreboard Overlay: See 7.1

.7 Membranes:

.1 Composite Fibreboard: Soprema Soprabase FR 180 Board or Roofcraft 180 Base FR, composite overlay board with base sheet factory laminated to its surface, 25mm thickness. No substitutions.

.1 Description: High strength wood fibreboard with factory-applied base sheet on the top surface. Fibreboard is impregnated with fire retardant with a flame spread rating not more than 25.

.2 Base Sheet Stripping: Soprema Sopralene Flam 180 or IKO Torchflex TP 180 FF Base. No substitutions.

.1 Description: Roofing membrane with a 180 g/m^2 non-woven polyester reinforcement and thermofusible SBS modified bitumen. Both sides shall be protected by a thermofusible plastic film. This membrane is to be applied by torching only.

.3 Self-adhesive Base Sheet Stripping: Soprema Sopralene Flam Stick or IKO Armourbond 180. No substitutions.

.1 For use at roof/wall junction as required onto dimensional wood wall.
.2 Description: Roofing membrane with a minimum 160 g/m^2 non-woven polyester and glass grid reinforcement and thermofusible SBS modified bitumen. The self-adhesive under-face is covered by a silicone release paper. The top face is covered by a thermofusible plastic film.

.4 Membrane Cap Sheet: Soprema Sopralene Flam 250 Granular or IKO Torchflex TP 250 Cap. No substitutions.

.1 Description: Roofing membrane with a 250 g/m^2 non-woven polyester reinforcement thermofusible SBS modified bitumen. The top side is self-protected with coloured ceramic granules. The underside is protected with a thermofusible plastic film. The membrane is to be applied by torching only.

.5 Cap Sheet Stripping: Soprema Sopralene Flam 250 Granular or IKO Torchflex TP 250 Cap. No substitutions.

.8 Accessories:

.1 Roofing Nails, Screws and Plates: Galvanized.
.2 Mastic: SBS Modified Bitumen Plastic Cement by Soprema or Roofcraft Modified Plastic Cement for IKO products. No substitutions.

.3 Reinforcement Membrane for vents, chimneys and drains: Soprema Sopralene Flam 180 or IKO Torchflex TP 180 FF Base. No substitutions.

.4 Roof Lumber: Construction grade spruce kiln dried, plywood (19mm) and dimensional lumber for fully sealed applications (i.e. curbs, parapets, etc.). Pressure treated PWF Plywood (19mm) and dimensional lumber for exposed applications (i.e. equipment sleepers, etc.)

.5 Primer: Soprema Elastocol 500 and Elastocol 700 for self-adhesive membrane stripping or Roofcraft Modified Asphalt Primer for IKO product installation. No substitutions.

.6 Scuppers: Refer to Section 07625.

.7 Gum Boxes: SBS Modified Bitumen Pitch Pocket Filler, complete with aluminum pigmentation.

.8 Roof Drain: Thaler Roofing Specialties Products Inc. RD-29A Aluminum Roof Drains complete with new aluminium strainers (100mm diameter).

.9 Roof Blocks: Better Idea Inc. RB-01 Quick Block.

3. EXECUTION

3.1 EXAMINATION AND PREPARATION OF SURFACES

.1 Inspect and approve the deck condition (slopes and nailing supports, if applicable) as well as parapet walls, roof drains, stack vents, vent outlets and others, building joints, etc. before commencing work. Commencement of work shall imply acceptance of surfaces and conditions.

.2 All surfaces must be smooth, dry, clean and free of ice and debris before commencing work. Do not use salt or calcium to remove ice or snow.

.3 Check if the work of other trades has been properly completed.

.4 Do not install materials in conditions of rain, snow or fog.

3.2 METHOD OF EXECUTION

.1 Install roofing elements on clean and dry surfaces.

.2 Perform roofing work on a continuous basis as surface and weather conditions allow.

.3 Protect adjoining surfaces against any damage that could result from the roofing installation.

.4 Apply only as much insulation to the roof as can be covered the same day with roofing membrane. At the conclusion of each day's work, seal exposed edges of the roof insulation. Cut and remove this seal upon continuation of the work.

3.3 EQUIPMENT

.1 Maintain all equipment and tools in good working order.

.2 Use only torch types recommended by the manufacturer of the elastomeric asphalt

membranes.

3.4 ASPHALT PRIMER APPLICATION

.1 Apply asphalt primer coating on all wood and metal surfaces where membrane is torch applied. Primer application is required for self-adhesive membrane.

3.5 ASPHALT FLOOD COAT APPLICATION

.1 Not applicable.

3.6 VAPOUR BARRIER INSTALLATION

.1 Install vapour barrier according to ARCA and roofing materials manufacturer's specifications. Fully mopped according to roofing materials manufacturer's specifications and details.

3.7 INSULATION PANEL INSTALLATION

.1 Ensure that the insulation is protected from the elements. Apply only as much insulation to the roof as can be covered the same day with roofing membrane.

.2 Lay boards with firm contact, with end joints staggered in successive rows. Fill gaps with cut pieces of insulation.

.3 Imbed insulation boards into a full mopping of asphalt at a rate of 1.2kg/m^2 over vapour barrier.

.4 Where sloped insulation is used, lay sloped insulation onto asphalt bed first and backmop primary insulation over sloped sections.

3.8 COMPOSITE FIBREBOARD OVERLAY INSTALLATION

.1 Install rigid composite overlay board with base sheet factory laminated to its surface over the primary insulation boards with joints offset from the joints of the preceding layer a minimum of 150mm.

.2 Install composite fibreboard overlay over isulation by using mechanical fasteners, compatible adhesives, or embed in a full mopping of asphalt at a rate of 1.5 kg/m^2.

.3 To adhere the composite fibreboard to the insulation, the asphalt temperature can be between 150°C - 190°C (300°F - 375°F) at point of application to ensure a good weld in colder weather.

.4 Ensure boards are butted tightly with no gaps.

3.9 BASE SHEET INSTALLATION

.1 The base sheet has been factory laminated to the rigid composite overlay board. A separate base sheet is not required.

3.10 BASE SHEET STRIPPING INSTALLATION

.1 Primer must be dry before application of base sheet stripping.

.2 Lay base sheet stripping in metre wide strips to the vertical surfaces, extending onto base sheet a minimum of 100mm. Ensure 75mm side laps, staggered a minimum of 100mm from the base sheet laps to avoid excessive thickness.

.3 For curbs and parapets with fascia boards, extend the base sheet stripping over top of up stand and down outside face a minimum of 75mm. Extend base sheet stripping 50mm past wall/roof junction if there is no fascia board.

.4 Torch weld base sheet stripping directly to substrate from bottom to top by heating and softening bitumen on underside resulting in uniform adhesion over the entire surface. Avoid overheating.

.5 For self-adhesive membrane, apply to primed substrate by removing the silicone release paper and install from bottom to top. Press firmly and uniformly to obtain total bond. Nail at 300mm on centre along top edge. Torch off plastic film on base sheet where stripping will overlap (100mm).

3.11 CAP SHEET INSTALLATION

.1 Once the base sheet and stripping has been applied and does not show any defects, the cap sheet can then be laid.

.2 Unroll the cap sheet starting from the lowest point of the roof. Re-roll cap sheet from both ends prior to torching. Care must be taken to ensure alignment of the first roll (parallel with the edge of the roof).

.3 Torch weld cap sheet on to the base sheet membrane. During this application, simultaneously melt both surfaces, forming an asphalt bead that is pushed out in front of the cap sheet.

.4 Avoid overheating.

.5 Stagger base sheet and cap sheet seams a minimum of 300mm.

.6 Ensure cap sheet side laps of 75mm and end laps 150mm. Embed surface granules on end laps prior to installation of following sheet. Torch welding speed varies depending on the weather.

.7 Make sure the two (2) membranes are properly welded without unwelded areas. Avoid excessive asphalt seepage along the joints.

.8 After installation of the cap sheet, check all lap seams on the cap sheet.

3.12 CAP SHEET STRIPPING INSTALLATION

.1 Lay cap sheet flashing in strips one metre wide. Ensure at least 150mm (6") of cap sheet overlap on the deck. Ensure side laps of 75mm and stagger a minimum of 100mm from cap sheet laps.

.2 Using a chalk line, lay-out a straight line on the cap sheet surface, parallel to roof edge, 150mm inside the roof from the base of the cant strip. Using a torch and round nosed roofing trowel, embed the surface granules into the heated and soft bitumen, from the chalk line to the edge of the cap sheet. Torch weld cap sheet flashing directly on its base sheet, proceeding from bottom to top. Avoid overheating.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 50 50 – Bituminous Membrane Roofing General Requirements

1.2 WORK INCLUDED

.1 Base/drip flashings

.2 Pre-finished Brake Metal

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI/SPRI/FM 4435/ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems 2011.

.2 ASTM International (ASTM)

.1 ASTM A 792/A 792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 ASTM D4587-11 Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.

.3 ASTM F1667-15 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.3 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 2012.

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI S8-2008 Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.

.2 CSSBI B17-2002 Barrier Series Prefinished Steel Sheet: Product Performance & Applications.

.3 CSSBI Sheet Steel Facts #12 2003 Fastener Guide for Sheet Steel Building Products.

.5 CSA Group

.1 CSA A123.3-05(2015), Asphalt Saturated Organic Roofing Felt.

.2 CSA A123.22-08(2013) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

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

.1 Safety Data Sheets (SDS).

1.4 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 on access routes. Keep in place until completion of Work.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Handle and store flashing materials to prevent creasing, buckling, scratching, or other damage.

Part 2 Products

2.1 SHEET METAL

.1 Galvanized steel: minimum 24-gauge core steel; conforming to requirements of ASTM A525 G90 Galvanized Coating.

.2 Prefinished galvanized flashing: ASTM A446; G90 zinc coating; 24-gauge core steel; shop precoated; Colour as per schedule.

2.2 ACCESSORY MATERIALS AND COMPONENTS

.1 Fasteners: concealed clip type, of same materials as flashings; sized to suit application.

.2 Rubber-asphalt sealing compound: conforming to requirements of CGSB37-GP-5M.

.3 Bituminous paint: acid and alkali resistant type; black colour.

2.3 FABRICATION

.1 Fabricate metal flashings in accordance with recommendations of CRCA and as indicated on Drawings.

.2 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.3 Form sections in 2438 mm (8 ft) lengths. Make allowances for expansion at joints.

.4 All seams are to be flat lock type except corners. Fabricate corners minimum 460 mm, mitred, soldered or welded, and sealed as one (1) piece.

.5 Hem exposed edges of flashings on underside 13 mm.

.6 Backpaint flashing with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Fabricate scuppers as detailed.

Part 3 Execution

3.1 EXAMINITATION

.1 Verify membrane termination and base flashings are in place, sealed, and secure.

.2 Beginning of installation means acceptance of existing conditions.

3.2 PREAPARATION

.1 Field measure Site conditions prior to fabricating Work.

.2 Install starter and edge strips, and cleats before starting installation.

3.3 INSTALLATION

.1 Install flashings in accordance with CRCA recommendations and as indicated on Drawings.

.2 Secure flashing in place using concealed type fasteners. Use exposed fasteners in locations approved by the Contract Administrator only. When using exposed fasteners, they are to be of the same finish as flashings.

.3 Apply sealing compound at junction of metal flashings and asphalt felt flashings.

.4 Lock seams and end joints. Fit flashing tight in place. Make corners square, surfaces true and straight in all planes and all lines accurate to profiles.

.5 Counter-flash all mechanical and electrical items projecting through.

.6 Install galvanized flashing to all locations indicated on Drawings.

.7 Install pre-finished flashing to all locations indicated on Drawings.

.8 Seal metal joints watertight.

3.4 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Bituminous Membrane Roofing General Requirements: Section 07 50 50.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Store materials off ground and under cover in a dry, well-ventilated enclosure.

.2 Stack preformed material in manner to prevent twisting, bending, and rubbing.

.3 Provide protection for galvanized and prepainted surfaces.

.4 Prevent contact of dissimilar metals during storage and protect from acids, flux, and other corrosive materials and elements.

2. PRODUCTS

2.1 MATERIALS

.1 Galvanized Steel Sheet: commercial quality sheet to ASTM A653-M96, with Z275 designation zinc coating.

.2 Prepainted Galvanized Steel: commercial quality to ASTM A653-M96 with Z275 zinc coating prepainted with baked on enamel with colours of proven durability for exterior exposure, to CSSBI Technical Bulletin No. 7, 5000 series.

.3 Solder: 50% pig lead and 50% block tin.

.4 Flux: commercial quality as recommended by sheet metal manufacturer.

.5 Flashing Nails: #12 hot dipped zinc coated, annular ringed.

.6 Sheet Metal Screws: Cadmium plated, self tapping, pan head.

.7 Bituminous Paint: solvent type, to CAN/CGSB-1.108-M89, type II.

.8 Plastic Cement: cutback asphalt type, to CAN/CGSB-37.5-M89.

.9 Sealing Compound: rubber-asphalt, to CAN/CGSB-37.29-M89.

.10 Sealant: one component, elastomeric, chemical curing, CAN/CGSB-19.13-M87.

.11 Recessed Reglet: preformed 0.70 mm thick galvanized steel channel with face and ends covered with plastic tape.

.12 Flashing Anchor Clips: 0.80 mm thick galvanized steel.

2.2 FABRICATION, GENERALLY

.1 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.2 Backpaint sheet metal with bituminous paint on surface in contact with concrete, masonry, cementitious materials or dissimilar metal.

2.3 FABRICATION, FLASHING

.1 Maximum Joint Spacing:

.1 Parapet Face Flashings: 1200 mm.
.2 Cap Flashing 300 mm and Greater in Width: 1200 mm.
.3 All Other Flashings: 2400 mm.

.2 Construct flashing joints to allow for flashing movement, using flat "S" lock seams.

.3 Maintain minimum of 22 mm lap at all joints. Provide 25 mm anchor projection of "S" locks.

.4 At inside and outside corners, mitre the joint, and use upstanding seams, 25 mm minimum height and 22 mm minimum lap.

.5 Maintain minimum 1:5 slope on horizontal surfaces of flashings, parapets and control joints.

.6 Hem exposed edges on underside of all flashings.

.7 Fabricate cap flashing to have a drip leg minimum 110 mm high.

.8 Fabricate cap and counter flashings to lap 100 mm over base flashings.

2.4 FABRICATION, ROOF ACCESSORIES

.1 Form sheet steel from 0.70 mm galvanized steel.

3. EXECUTION

3.1 EXAMINATION OF SURFACES

.1 Examine surfaces to receive flashings. Notify the Contract Administrator of surfaces which are considered unacceptable to receive the work of this Section.

.2 The commencement of flashing work will imply unconditional acceptance of the surfaces and substrates to which the flashing is to be fastened.

.3 Verify that the following are located and installed as detailed on drawings:

.1 Plywood and lumber nailer plates to walls and parapets.
.2 Control joints.

3.2 PROTECTION OF EXISTING WORK

.1 Protect the work of other Sections from damage by the work of this Section.

.2 Place protection to the requirements and satisfaction of this Section before performing the work of other Sections.

3.3 FLASHING INSTALLATION, GENERALLY

.1 Install flashings not later than seven days after installation of the membrane on any particular section of the roof.

.2 Use 0.80 mm thick x 150 mm long anchor clips on fascia faces, and screws or annular ringed nails on the opposite face.

.3 Use exposed fastenings in approved locations. Install anchors using annular ringed nails.

.4 Fasten flashings of 1.2 m length and shorter, through the extended "S" locks. Fasten flashings over 1.2 m length, through the extended "s" locks, and at mid-length with a 150 mm long, 0.80 mm thick galvanized steel clip.

.5 Fasten flashings at maximum 600 mm O.C.

.6 Where possible, do not set base flashing screws less than 200 mm from top of roof membrane.

3.4 INSTALLATION OF FLASHING JOINTS

.1 Fit flashings together so that one end of each section is free to move in the joint. Do not use sealant at joints.

.2 Wipe and wash clean, soldered joints to remove traces of flux, immediately after soldering.

3.5 INSTALLATION AT REGLETS

.1 Assist in locating and installing recessed reglets, as required.

.2 Confirm reglet installation and report defects to the Contract Administrator.

.3 Insert metal flashing into reglets to form tight fit.

.4 Seal flashing into reglet with sealant.

3.6 GUM BOX INSTALLATION

.1 Fill gum boxes with plastic cement in two equal lifts. Separate lifts with one ply of organic felt, precision cut to fit the box.

.2 Built-up Roofing Membranes: apply two plies of organic felt stripping over flange and extend up face of box curb. Reinforce stripping with 2 layers of woven glass cloth.

.3 Modified Bituminous Roofing: apply roofing and flashing to membrane manufacturer's printed instructions.

3.7 SPLASH PAN INSTALLATION

.1 Not used

3.8 VENT STACK INSTALLATION

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 50 50 – Bituminous Membrane Roofing General Requirements

.2 Section 07 55 00 – Modified Bituminous Membrane Roofing

.3 Section 07 62 20 – Metal Flashings for Bituminous Roofing

1.2 WORK INCLUDED

.1 Supply and installation of all sealants and backing materials as required.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 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.

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

.1 Safety Data Sheets (SDS).

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 joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit two (2) copies of WHMIS SDS in accordance with Section 01 35 29.06- Health and Safety Requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.6 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 indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 ENVIRONMENTAL CONDITIONS

.1 Sealant and substrate materials to be minimum 5˚C.

.2 Should it become necessary to apply sealants below 5˚C, consult sealant Manufacturer and follow their recommendations.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Health Canada.

Part 2 Products

2.1 MATERIALS

.1 Primers: type recommended by sealant Manufacturer.

.2 Joint Cleaner: Noncorrosive solvent recommended by sealant manufacturer for applicable substrate material.

.3 Joint fillers

.1 General: compatible with primers and sealants, outsized 30 to 50%.

.2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.

.3 Neoprene or butyl rubber: round solid rod, Shore A hardness 70.

.4 Polyvinyl chloride or neoprene: extruded tubing with 6mm minimum thick walls.

.5 Impregnated precompressed polyurethane foam sealant tape.

.6 Acceptable Product: Emseal “Grayflex” or approved equal in accordance with B7.

.3 Bond breaker: pressure sensitive plastic tape, which will not bond to sealants.

.4 Sealants

.1 Sealant shall be UV-resistant and ozone resistant, capable of supporting their own weight, conforming to CAN2-19.13.

.2 Sealants for vertical and horizontal non-traffic bearing joints, to Table 1, CGSB19-GP-23.

.3 Colour of sealants shall match adjacent surface. Colours to be selected by the Contract Administrator, from standard colour range.

.4 Joint cleaner: xylol, methylethylketone or non-corrosive type recommended by sealant Manufacturer and compatible with joint forming materials.

2.2 ACCEPTABLE PRODUCTS

.1 For all non-traffic bearing joints unless indicated otherwise Dow Corning No. 790 or approved equal in accordance with B7.

.2 For joints between exterior doors, windows, ductwork, etc., and adjacent materials: Dow Corning No. 795 or approved equal in accordance with B7.

Part 3 Execution

3.1 PREPARATION

.1 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.

.2 Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease, and other coatings from nonferrous metals with joint cleaner.

.4 Prepare concrete, glazed, and vitreous surfaces to sealant Manufacturer’s instructions.

.5 Examine joint sizes and correct to achieve depth ratio one-half of joint width with minimum width and depth of 6 mm, maximum width 25 mm.

.6 Install joint filler to achieve correct joint depth.

.7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.8 Apply bond breaker tape where required to Manufacturer’s instructions.

.9 Prime sides of joints in accordance with sealant Manufacturer's instructions immediately prior to caulking.

3.2 APPLICATION

.1 Apply sealants, primers, joint fillers, bond breakers, to Manufacturer's instructions. Apply sealant using gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.

.2 Apply sealant to joints between door frames to adjacent building components, around perimeter of every external opening, to control joints in concrete slabs and where indicated.

3.3 CLEANING

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

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

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealants.

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

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Bid Opportunity 479-2024

.2 Section 05 50 00 - Metal Fabrications

1.2 WORK INCLUDED

.1 Prepare surfaces which are to receive finish. Surfaces include underside steel deck, steel joists and concrete unit masonry.

.2 Finish surfaces as indicated in the schedule at the end of this Section.

1.3 REFERENCE STANDARDS

.1 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

.2 SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.

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

.1 Safety Data Sheets (SDS).

.3 Master Painters Institute (MPI)

.1 The Master Painters Institute (MPI)/Architectural Painting Specification Manual (ASM) - current edition.

.2 Standard GPS-1-12, MPI Green Performance Standard.

.3 Standard GPS-2-12, MPI Green Performance Standard.

.4 National Research Council Canada (NRC)

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

.5 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.4 QUALITY ASSURANCE

.1 Acceptable Manufacturers, materials, workmanship and all items affecting the Work of this Section are to be in accordance with CPCA Architectural Painting Specification Manual.

.2 Prior to ordering paints, submit to the Contract Administrator for review a complete schedule of paint materials proposed for use. This schedule shall include Manufacturer’s name, brand name or code number, type and recommended application.

1.5 COLOR SCHEDULE

.1 Paint colours shall be as per room finish schedule and as selected by the Contract Administrator.

.2 Prior to commencement of Work, the Contract Administrator will furnish three (3) copies of colour schedule.

1.6 DELIVERY

.1 Deliver paint materials in sealed original labelled containers, bearing Manufacturer’s name, type of paint, brand name, colour designation and instructions for mixing or reducing.

1.7 STORAGE

.1 Provide adequate storage facilities. Store paint materials at a minimum ambient temperature of 8°C and in a well-ventilated area.

.2 Take all precautionary measures to prevent fire hazards and spontaneous combustion.

1.8 ENVIRONMENTAL CONDITIONS

.1 Materials and products in accordance with Section 01 47 15- Sustainable Requirements: Construction.

1.9 PROTECTION

.1 Adequately protect other surfaces from paint and damage. Make good any damage as a result of inadequate or unsuitable protection.

.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

.3 Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from Site.

.4 Remove all electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of Work in each area. Do not use solvents that may remove the permanent lacquer finish to clean hardware.

1.10 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's instructions, printed product literature and data sheets for paint and paint products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedure.

.3 Confirm products to be used are in MPI's approved product list.

.3 Upon completion, provide records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Safety Data Sheets (SDS).

.6 MPI #

.4 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Prepare 300 mm x 200 mm samples of paint type finishes when requested by Contract Administrator. Apply finishes on identical type materials to which they will be applied on job.

.3 Identify each sample as to finish, colour name and number and sheen name and gloss units.

.5 Test reports: Provide certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.6 Certificates: Provide certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties. MPI Gateway #.

.7 Manufacturer's Instructions:

.1 Provide manufacturer's installation and application instructions.

1.11 CLOSEOUT SUBMITTALS

.1 Provide in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Provide operation and maintenance data for painting materials for incorporation into manual.

.3 Include:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour number[s].

.4 MPI Environmentally Friendly classification system rating.

1.12 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Paint materials to be Products of a single Manufacturer.

.2 All painting materials shall be the best quality and shall be accepted by the Contract Administrator.

.3 Paint shall not be settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency, and shall have excellent application properties.

.4 Paint shall arrive on the job colour-mixed except for tinting of undercoats and possible thinning.

.5 All thinning and tinting materials shall be as recommended by the Manufacturer for the particular material thinned or tinted.

.6 Mixed colours shall match colour selection made by the Contract Administrator prior to application of the coating.

.7 Paint shall be ready mixed except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.

.8 Paint shall have good flow and brushing properties, and be capable of drying or curing free of streaks or sags.

.9 Paint accessory materials: Linseed oil, shellac, turpentine, and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

.10 Paint Acceptable Manufacturers: Dulux, Benjamin Moore, C.I.L., or approved equal in accordance with B7.

Part 3 Execution

3.1 CONDITIONS OF SURFACES

.1 Thoroughly examine all surfaces schedule to be painted prior to commencement of Work. Report in writing to the Contract Administrator any condition that may potentially affect proper application. Do not commence until all such defects have been corrected.

.2 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below maximums established by the paint Manufacturer.

.3 Beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION OF SURFACES

.1 Impervious Surfaces: remove mildew by scrubbing with a solution of TSP and bleach. Rinse with clean water and allow surface to dry completely.

.2 Insulated Surfaces: remove dirt, grease and oil from canvas and cotton insulated coverings.

.3 Galvanized surfaces: remove surface contamination and oils from surfaces and wash with solvent. Apply a coat of etching type primer.

.4 Zinc coated surfaces: remove surface contamination and oils from surfaces and prepare for priming in accordance with metal Manufacturer’s recommendations.

.5 Remove stains caused by weathering of corroding metals from concrete with a solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.

.6 Steel and iron surfaces: remove grease, rust, scale, dirt and dust from surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure all steel surfaces are satisfactory before paint finishing.

.7 Unprimed steel surfaces: clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to identify defects. Prime paint after defects have been remedied.

.8 Concrete and unit masonry surfaces scheduled to receive paint finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate, rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

.9 Specialty Coating for UV shall be prepared for according to any additional instructions by Manufacturer.

3.3 APPLICATIONS

.1 Apply paint and other finishes in accordance with good trade practice.

.2 Finishes specified are intended to cover surfaces satisfactorily when applied in accordance with Manufacturer's recommendations.

.3 Apply each coat at the proper consistency.

.4 Each coat of paint is to be slightly darker than the preceding coat unless otherwise acceptable to the Contract Administrator.

.5 Sand lightly between coats to achieve required finish.

.6 Do not apply finishes on surfaces that are not sufficiently dry.

.7 Allow each coat of finish to dry before a following coat is applied, unless directed otherwise by Manufacturer.

3.4 PROCESS, MECHANICAL, AND ELECTRICAL EQUIPMENT

.1 Refer to Process, Mechanical, and Electrical Sections with respect to painting and finishing requirements.

.2 Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.

.3 Finish paint primed equipment.

.4 Prime and paint insulated and exposed pipes, conduits, boxes, hangers, brackets, collars and supports to match adjacent Work, except where items are plated or pre-finished unless otherwise noted as being painted as separate colour than surrounding Work - refer to Section 15010.

.5 Replace identification markings on mechanical or electrical equipment when painted over or spattered.

.6 Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvres with one (1) coat of flat black paint to limit of sight line. Paint dampers exposed behind louvres, grilles, convector and baseboard cabinets to match face panels.

.7 Paint exposed conduit and electrical equipment occurring in finished areas including baseboard heaters and force flow heaters. Colour and texture are to be selected by Contract Administrator.

.8 Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and before mounting equipment on them.

.9 Colour coding equipment, piping, conduit and exposed ductwork and all colour banding and identification (flow arrows, naming, numbering, etc.) shall be performed to the requirements of Divisions 11 and 15. Piping and ductwork not required to be coded shall be painted in accordance with Mechanical and Process colour schedules.

.10 Paint all exposed exterior mechanical and electrical equipment that has not been factory finished.

3.5 PROTECTION

.1 Protect other surfaces from paint or damage. Repair damage.

.2 Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

.3 Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from Site.

3.6 CLEANING

.1 As Work proceeds and upon completion, promptly remove all paint where spilled, splashed or spattered.

.2 During the progress of Work keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Upon completion of Work leave premises neat and clean, to the satisfaction of the Contract Administrator.

3.7 PAINTING AND FINISHING SCHEDULE

.1 Interior Painting:

.1 Primed Metal Surfaces:
  .1 One (1) coat enamel undercoat
  .2 Two (2) coats alkyd semi-gloss enamel

.2 Galvanized Metal Surfaces:
  .1 One (1) coat galvanized iron primer
  .2 Two (2) coats alkyd semi-gloss

.3 Concrete Block
  .1 One (1) coat latex block filler
  .2 Two (2) coats alkyd enamel semi-gloss finish

.4 Concrete Floors, Curbs, and Equipment Bases:
  .1 Two (2) coats Epoxy Flooring
    .1 Approved Product: Sikafloor 261 or approved equivalent.

.5 Concrete Walls:
  .1 Two (2) coats alkyd enamel semi-gloss finish

END OF SECTION

Part 1 General

1.1 RELATED DOCUMENTS

.1 Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

.1 This Section includes one resinous flooring system, one with epoxy body.

.1 Application Method: Metal, power or hand troweled.

1.3 SUBMITTALS

.1 Product Data: For each type of product indicated. Include manufacture's technical data, application instructions, and recommendation for each resinous flooring component required.

.2 Samples of Verification: For each resinous flooring system required, 150 mm square, applied to a rigid backing by Installer for this Project.

.3 Room Finish Schedule: Use resinous flooring indicated on Drawings in room finish schedule.

.4 Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

.5 Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

.1 No request for substitution shall be considered that would change the generic type of floor system specified (i.e. epoxy mortar-based system). Equivalent materials of other manufactures may be substituted only on approval of the contract administrator. Request for substitution will only be considered only if submitted 10 days prior to bid date. Request will be subject to specification requirements described in this section.

.2 Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

.1 Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring system indicated.

.2 Contractor shall have completed at least 10 projects of similar size and complexity.

.3 Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials,

including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

.4 Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

.1 Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

.5 Pre-installation Conference:

.1 General contractor shall arrange a meeting not less than thirty days prior to starting work.

.2 Attendance:

.1 General Contractor

.2 Manufacturer/Installer's Representative

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages and containers, with seals unbroken, bearing manufacture's labels indicating brand name and directions for storage and mixing with other components.

.2 Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

.3 All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing of volumetric measurements allowed.

1.6 PROJECT CONDITIONS

.1 Environmental Limitation: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

.1 Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.

.2 Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

.3 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

.4 Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.7 WARRANTY

.1 Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full year from date of installation or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

Part 2 Products

2.1 RESINOUS FLOORING

.1 Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include:

.1 Build of Broadcast or liquid rich type system will not be accepted and will result in a disqualification from bid.

.2 Acceptable Manufactures

.1 Stonhard Basis of design

.3 Products: Subject to compliance with requirements:

.1 Stonhard; Stonclad GS®. With topcoat Stonkote GS4.

.4 System Characteristics:

.1 Color and Pattern: Pewter

.2 Wearing Surface: Standard smooth with broadcast slip resistant texture.

.3 Integral Cove Base: not required.

.4 Overall System Thickness: nominal 6 mm.

.5 System Components: Manufacturer's standard components that are compatible with each other and as follows:

.1 Primer:

.1 Material Basis: Stonhard Standard Primer

.2 Resin: Epoxy

.3 Formulation Description: (2) two component, 100 percent solids.

.4 Application Method: Squeegee and roller.

.5 Number of Coats: (1) one.

.2 Mortar Base:

.1 Material design basis: Stonclad GS

.2 Resin: Epoxy

.3 Formulation Description: (3) three component, 100 percent solids

.1 Application Method: Metal Trowel

.2 Thickness of Coats: nominal 6mm

.4 Number of Coats: One

.5 Aggregates: Pigmented Blended aggregate

.3 Top Coat:

.1 Material design basis: Stonkote GS4

.2 Resin: Epoxy

.3 Formulation Description: (2) two component, 100 percent solids

.4 Type: pigmented

.5 Finish: standard

.6 Number of Coats: one

.6 System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

.1 Compressive Strength: 10,000 psi after 7 days per ASTM C 579.

.2 Tensile Strength: 1,750 psi per ASTM C 307

.3 Flexural Strength: 4,000 psi per ASTM C 580.

.4 Water Absorption: < 1% per ASTM C 413

.5 Impact Resistance: > 160 in. lbs. per ASTM D 2794

.6 Flammability: Class 1 per ASTM E-648

.7 Hardness: 85 to 90, Shore D per ASTM D 2240

2.2 ACCESSORY MATERIALS

.1 Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

.2 Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment. Unit prices should be included if the extent of control joints and non-moving cracks are not quantifiable at time of bid.

Part 3 Execution

3.1 PREAPARATION

.1 General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

.2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

.1 Mechanically prepare substrates as follows:

.1 Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

.2 Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

.2 Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

.3 Verify that concrete substrates are dry.

.1 Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.

.2 Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. of slab in 24 hours.

.3 Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.4 Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.3 Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

.4 Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

.5 Treat control joints and other non-moving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment.

3.2 APPLICATION

.1 General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

.1 Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

.2 Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

.3 At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

.1 Apply joint sealant to comply with manufacturer's written recommendations.

.2 Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

.3 Apply metal trowel single mortar coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

.4 Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 TERMINATION

.1 Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

.2 Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

.3 Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

.4 Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.4 JOINTS AND CRACKS

.1 Treat control joints to bridge potential cracks and to maintain monolithic protection.

.2 Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

.3 Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 FIELD QUALITY CONTROL

.1 Material Sampling: Contract Administrator may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.

.1 Contract Administrator will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.

.2 Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.

.3 If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 CLEANING, PROTECTING, AND CURING

.1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

.2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

.3 Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit manufacturer's printed product literature, specifications, and application instructions to Contract Administrator before commencing application.09 91 23 - Interior Painting

1.2 ENVIRONMENTAL CONDITIONS

.1 Maintain ambient and structural base temperature at installation area within limits specified by coating manufacturer. Apply coating during dry weather. Do not apply coating to wet or damp surfaces.Non-rated hollow steel doors

1.3 PROTECTION

.1 Protect plants and vegetation that might be damaged by coating. Protect surfaces not intended to have application of 1coatings. Provide adequate ventilation or isolation measures to protect against toxic fumes.

Part 2 Products

2.1 MATERIALS

.1 Graffiti-resistant coating: one component, water based, non-sacrificial, clear penetrating sealer and liquid repellent.
.2 Acceptable products: Fabrikem Fabrishield Paint Repellent PR-61 for clay brick.
.3 Or approved equal in accordance with B8.

Part 3 Execution

3.1 PREPARATION

.1 Prepare and clean substrate surfaces in accordance with coating manufacturer's instructions.

.2 Mix and prepare coatings to manufacturer’s instructions.

.3 Take moisture tests on substrates to receive coating to ensure moisture levels are within limits specified by coating manufacturer.

3.2 APPLICATION

.1 Apply coating using low pressure spraying apparatus, at recommended coverage rate for product and substrate.

.2 Apply in uniform, even coat to fully wet substrate, without flooding or rundowns.

.3 Allow area to dry completely before applying additional coats.

3.3 SCHEDULE

.1 Apply graffiti-resistant coating to clay brick.

Part 4 Measurement and Payment

4.1 METHOD OF MEASUREMENT AND PAYMENT

.1 Graffiti-Resistant Coatings

The supply and installation of graffiti-resistant coatings shall be considered incidental to the Contract Lump Sum Price for "Building Construction".

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Section 09 01 90.63 – Interior Painting.

1.2 QUALITY ASSURANCE

.1 Provide labels to CSA and ANSI Standards.

2. PRODUCTS

2.1 TAGS, LABELS AND BANDING

.1 HVAC Valve Tags: tags with 12 mm high lettering and brass jack chain for fastening to valve. Following types of valve tags are acceptable:

.1 Brass tags: 40 mm diameter affixed to valve with brass jack chain.
OR
.2 50 mm x 50 mm fibreglass tags.
OR
.3 40 mm diameter anodized aluminum tags.

.2 Laminated Plastic Nameplate: self-adhesive composite laminated plastic nameplates with one smooth white surface and core of black plastic. Designed to leave black lettering on a white background when engraved.

.1 Mechanical Equipment: engraved lettering 20 mm high.

.2 Panels and Panel Mounted Equipment: engraved lettering 20 mm high.

.3 Equipment Cabinet front mounted switches and displays: engraved lettering 8 mm high.

.3 Colour Banding Tape: adhesive backed plastic tape, integrally coloured.

.4 Identification Labels: adhesive backed plasticized labels, yellow colour, with:

.1 Legends consisting of black lettering, minimum 50 mm high.

.2 Black direction of flow arrows.

.3 Fasten labels with mechanical fastener in addition to adhesive backing on labels.

.5 Stencils: 50 mm high black lettering and flow arrows.

2.2 VALVE TAG DIRECTORY

.1 Provide a typewritten of all valves identifying the following information:

.1 Valve number

.2 Location

.3 Service

.4 Make/model size

.5 With/without handwheel

.6 Type of control

3. EXECUTION

3.1 LABELS

.1 Use identification labels or stencils to apply legends and direction of flow arrows, as detailed in CGSB 24-GP-3A Colour Standard Colour Coding Requirements, and as follows:

.1 Apply to full colour coded mechanical piping and to mechanical ductwork in sufficient numbers of locations to provide easy identification.

.2 Apply to intermittent colour coded mechanical piping wherever colour coding bands occur.

.2 Adhere labels with sufficient coat of contact cement to ensure permanent adhesion. Seal with two coats of clear lacquer.

.3 Apply pipe and duct labels at 15 m intervals, before and after pipes pass through walls, at access door openings, adjacent to mixing points, and equipment.

.4 Identify major mechanical equipment with laminated plastic nameplates.

.5 Identify electric starting switches, electric disconnects and remote push buttons with laminated plastic nameplates.

3.2 NAMEPLATES

.1 Provide name/data plates on major equipment components with manufacturer's name, model number, serial number, capacity and electrical data. Attach plate in a conspicuous place.

3.3 TAGS

.1 Tag all valves in mechanical rooms, and all circuit balancing and isolating valves external to mechanical room except valves at terminal heating and cooling equipment.

.2 Identify and tag air terminal boxes and radiator valves with numbers.

.3 Identify and tag thermostats relating to terminal boxes and valve numbers.

.4 Identify and tag temperature sensors or intelligent thermostats by mnemonic and related terminal box and valve numbers.

3.4 LOCATION IDENTIFICATION

.1 Provide equipment, valve and damper location tacks or adhesive disks in T-bar type ceilings, colour coded as follows:

.1 Yellow - HVAC Equipment

.2 Red - Fire Dampers/Smoke Dampers

.3 Green - Plumbing Valves

.4 Blue - Heating/Cooling Valves.

.5 Black - Control dampers and sensors

.2 Locate tacks or disks in corner of T-bar panel closest to equipment.

3.5 IDENTIFICATION SCHEDULES

.1 Colour numbers for Identification Labels on piping systems, valves and equipment are defined in Federal Standard 595C Colours for colour code identification.

- Black : 17038
- Yellow : 13591
- Green : 14193
- Orange : 12473
- Brown : 10115
- Red : 11350
- White : 17860
- Aluminum : 16515
- Blue : 15180
- Grey : 16293
- Light Blue : 15450
- Purple : 17155

.2 Pipe Identification Label Schedule:

Service	Background	Lettering	WHMIS Symbol	Legend
Domestic Cold Water	Light Blue	White	N/A	DOMESTIC COLD WATER

Drains	Aluminum	Green	N/A	DRAIN
Vent	Aluminum	Green	N/A	VENT

.3 Mechanical Equipment Painting:

Heat Exchangers (hot)	Yellow
Heat Exchangers (cold)	Green
Hot Water Storage Tanks	Yellow
Cold Water Storage Tanks	Blue

.4 Ductwork:

Identify all ductwork with Identification Labels as follows, complete with directional arrows:

Service	Background Lettering	Legend
Return Air	Blue White	RETURN AIR
Supply Air	Blue White	SUPPLY AIR
Mixed Air	Blue White	MIXED AIR
Combustion Air	Blue White	COMBUSTION AIR
Relief Air	Blue White	RELIEF AIR
General Exhaust Air	Blue White	GENERAL EXHAUST AIR
Toilet Exhaust	Blue White	TOILET EXHAUST AIR

.5 Identify duct access panels with Identification Labels, conforming to the following schedule:

	Background	Lettering
Cleaning and service access	Yellow	Black
Controls, including heat sensors	Black	White
Dampers (backdraft, balance and control)	Blue	White
Fire dampers	Red	White
Smoke dampers and detectors	Red	White

.6 Equipment Bases/Housekeeping Pads:

.1 Grey, with 100 mm yellow and black angled bands around edges.

.7 Buried Piping:

Utilize a detectable metallized ribbon laid 150 mm below ground level and above the buried pipe. Ribbon to display the same information as Identification Labels in intervals not exceeding 800 mm.

3.6 LOCATION OF LABELS

.1 Orient labels on piping systems in visual sight lines while standing at floor levels.

.2 Locate labels as follows:

.1 Upstream of valves.

.2 Adjacent to changes in direction.

.3 Branches.

.4 Where pipes pass through walls or floors.

.5 On straight pipe runs at 6 m intervals.

.6 For natural gas and propane piping systems, at 6 m intervals on straight pipe runs.

.7 Where system is installed in pipe chases, ceiling spaces, shafts, or similar confined spaces, at entry and exit points and at access openings

.8 At beginning and end points of each run and at each piece of equipment.

.3 Adhere labels to piping/insulation. Labels to cover entire pipe circumference. Secure both ends of labels with 50 m wide black tape around the entire pipe circumferences.

3.7 RECORD PROVISIONS

.1 Mark valve numbers on Red Line system schematic drawings for transfer onto record drawings. Include copies of Operation and Maintenance Manuals.

3.8 VALVE TAGS

.1 Tag pneumatic/electric controls, instruments and relays. Key to control schematics on which instruments are numbered in sequence.

.2 Tag all valves in mechanical rooms.

.3 Tag all control valves external to mechanical rooms. This includes control valves on radiant panels,

perimeter radiation and air terminal boxes.

.4 Tag all circuit balancing and isolating valves external to mechanical rooms except valves at terminal heating and cooling equipment.

.5 Identify and tag pneumatic/electric thermostats relating to terminal unit and valve numbers.

3.9 NAMEPLATES

.1 Identify the following with engraved plastic nameplates:

.1 All mechanical equipment.

.2 Air terminal boxes, VFDs.

.3 Pneumatic/electric thermostats.

.4 Electric starting switches, electric disconnects, remote push buttons and control panels.

.2 All nameplates to be mechanically fastened, easily visible without need to use ladder or extraordinary.

body position. Affix additional nameplates if necessary.

.3 Provide the Contract Administrator with an example of the contents of each type of nameplate.

Obtain approval prior to engraving.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Bid Opportunity 479-2024 - Mechanical General Requirements

1.2 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 1 for requirements pertaining to product options and substitutions.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Comply with requirements of Bid Opportunity 479-2024

.2 Submit an insulation schedule, for each application include the following information:

.1 Materials

.2 "k" value

.3 Thickness

.4 Density

.5 Finish

.6 Jacketing

.3 Submit product data and test reports when requested to substantiate that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements for the assembly and thickness used.

.4 Submit information showing installed insulation and membrane products meet the requirements of the National Energy Code of Canada for Buildings (NECB) and ASHRAE 90.1.

1.4 DEFINITIONS

.1 For the purposes of this Section, the following definitions apply:

.1 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

.2 UL GREENGUARD: Provides independent third-party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product-related pollutants. Certification is based upon criteria used by EPA, OSHA, and WHO.

.3 ASJ: All Service Jacket (no outer film).

.4 SSL: Self-Sealing Lap.

.5 FSK: Foil Scrim Kraft; jacketing.

.6 PSK: Poly Scrim Kraft; jacketing.

.7 PVC: PolyVinyl Chloride.

.8 Glass Mineral Wool: Interchangeable with fiber glass, but replacing the term in the attempt to disassociate and differentiate Glass Mineral Wool from the potential health and safety of special purpose or reinforcement products that do not meet the bio solubility criteria of insulation made from glass. Rock Mineral Wool will replace the traditional Mineral Wool label. Both are used in lieu of the Mineral Fiber label.

.9 Concealed: piping systems and equipment in trenches, shafts, furring, and suspended ceilings.

.10 Exposed: piping systems and equipment in mechanical rooms or otherwise not "concealed".

1.5 FLAME/SMOKE DEVELOPMENT RATINGS

.1 Pipe insulations, recovery materials, tapes, vapour barrier facings and adhesives shall have maximum flame spread rating of 25 and maximum smoke developed rating of 50, when tested in accordance with CAN/ULC-S102, NFPA 255, or ASTM E84.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C441.

1.6 QUALITY ASSURANCE

.1 Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

.2 Recycled Content: A minimum of 50 percent recycled glass content.

.3 Biosoluble: As determined by research conducted by the International Agency for Research on Cancer (IARC) and supported by revised reports from the National Toxicology Program (NTP) and the California Office of Environmental Health Hazard Assessment. Certified by European Certification Board for Mineral Wool Products (EUCEB).

.4 Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation Products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

.1 Fiberglas, Manson, Owens Corning, Knauf Insulation, Johns Mannville, Armaflex, Rubatex, Imcoa, Roxul, IIG, Kingspan, “Koolphen K”.

2.2 INSULATION MATERIALS

.1 Hot Pipe Insulation - Mineral Fibre:

.1 Comply with ASTM C 585, ASTM C 411, ASTM C 795, and ASTM C 547, Type I, and Type IV.

.2 Material: Hi-Lo Temp Formaldehyde Free, as validated by UL/E, glass mineral wool insulation to CAN/CGSB-51.9.

.3 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.

.4 Service Temperature: up to 150°C.

.5 Jacket: factory applied general purpose jacket of a white kraft bonded to a metalized polyester, reinforced with glass scrim.

.2 Hot Equipment Insulation - Flat Surfaces:

.1 Comply with ASTM C 612, Type IA, IB, II - Category I, or III

.2 Material: rigid glass mineral wool to CGSB 51-GP- 10M.

.3 "k" Value: maximum 0.035 W/m.°C at 24°C.

.4 Service Temperature: 20°C to 150°C.

.3 Cold Piping Insulation - Rigid Phenolic:

.1 Material: formed, rigid phenolic sleeving with closed cells.

.2 "k" Value: maximum 0.019 W/m°C at 24°C.

.3 Service Temperature: -40°C to 100°C.

.4 Jacket: factory applied vapour barrier.

.4 Cold Piping Insulation – Glass Mineral Wool:

.1 Comply with ASTM C 585, ASTM C 411, ASTM C 795, and ASTM C 547, Type I, and Type IV.

.2 Material: formed glass mineral woolrigid insulation to CGSB 51-GP-9M.

.3 “k” Value: maximum 0.035 W/m°C at 24°C.

.4 Service Temperature: -40°C to 100°C.

.5 Jacket: factory applied vapour barrier jacket of a white kraft bonded to a metalized polyester, reinforced with glass fibre scrim, to CGSB 1-GP-52M.

.5 Cold Pipe Insulation - Black Rubber

.1 Material: flexible elastomeric unicellular preformed pipe covering to CAN2 51.40-M80.

.2 "k" value: 0.039 W/m.°C at 24°C mean temperature.

.3 Service Temperature: -40°C to 100°C.

.4 Maximum Allowable Thickness: 13 mm.

.6 Cold Equipment Insulation - Flat Surfaces:

.1 Comply with ASTM C 612, Type IA, IB, II - Category I, or III

.2 Materials: rigid glass mineral wool to CGSB 51-GP- 10M; black rubber (flexible elastomeric unicellular sheet material).

.3 "k" Value: maximum 0.035 W/m°C at 24°C.

.4 Service Temperature: -14°C to 100°C.

.5 Jacket: factory applied vapour barrier to CGSB 51-GP-52M.

.7 Cold Equipment Insulation - Curved Surfaces:

.1 Complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB.

.2 Materials: glass mineralsemi-rigid blanket to CGSB 51-GP- 11M; black rubber (flexible elastomeric unicellular sheet material).

.3 "k" Value: maximum 0.035 W/m°C at 24°C.

.4 Service Temperature: -14°C to 100°C.

.5 Jacket: factory applied vapour barrier to CGSB 51-GP-52M.

2.3 ACCESSORIES

.1 For mineral fibre insulation materials:

.1 FSK Tape: vapor barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self-adhesive.

.2 ASJ Tape: vapor resistant tape consisting of all service jacket material with pressure sensitive self-adhesive.

.3 Adhesive: quick setting adhesive for joints and lap sealing.

.2 Black Rubber Insulation Adhesive: manufacturers recommended contact cement.

.3 Thermal Insulating and Finishing Cement: to ASTM C449 mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.

.4 Equipment Insulation: For all valves and fittings provide flexible removable insulation jackets.

2.4 RECOVERY MATERIALS

.1 Aluminum: to 0.5 mm thick smooth with longitudinal slip joints and 50 mm end laps, 0.4 mm thick die shaped fitting covers with factory attached protective liner on interior surface.

3. EXECUTION

3.1 INSTALLATION, GENERAL

.1 Apply insulation after required piping system tests have been completed and approved by the Contract Administrator.

.2 Do not insulate over any pressure vessel name plates.

.3 Ensure piping surface is clean and dry before insulating.

.4 Install in accordance with TIAC National Standards.

.5 Install in accordance with manufacturers recommendations.

.6 Ensure insulation is continuous through walls and floor penetrations.

.7 Locate cover seams in least visible locations.

.8 Stagger butt joints where multi-layered insulation is used.

.9 On vertical piping with diameters 25 mm and larger, use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Repeat supports on 4.5 m centers and at each valve and flange.

.10 Tightly fit insulation sections to pipe to make smooth and even surfaces. Cut insulation for proper fit where weld beads protrude. Bevel away from studs and nuts to allow their removal without damage to insulation. Trim closely and neatly around extending parts of pipe saddles, supports, hangers, clamp guides and seal with insulating/finishing cement.

.11 Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

.12 Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

.13 Install insulation with longitudinal seams at top and bottom of horizontal runs.

.14 Install multiple layers of insulation with longitudinal and end seams staggered.

.15 Keep insulation materials dry during application and finishing.

.16 Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

.17 Install insulation with least number of joints practical.

.18 Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

.19 Install insulation continuously through hangers and around anchor attachments.

.20 For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

.21 Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

.22 Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

3.2 HOT PIPE INSULATION APPLICATION

.1 Apply mineral fibre insulation when pipe surface temperatures are 15°C to 25°C.

.2 Apply mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Seal butt joints with a minimum 75 mm wide ASJ tape.

.3 Terminate mineral fibre insulation at each end of unions and flanges. Trowel finishing cement into bevel.

.4 Insulate fittings with preformed 2-piece insulation covers wherever possible. Otherwise field mitre the covers. Valve and flanges to be insulated with oversize pipe insulation.

OR

.5 Insulate fittings, valves, flanges and couplings with preformed 2-piece PVC insulation.

.6 Cut mineral fibre insulation layers straight on 10 m centers with 25 mm gap to allow for expansion between terminations. Pack void tightly with insulation and protect joints with aluminum sleeves.

.7 Recover all exposed insulated piping with PVC**.**

.8 Recover mineral fibre insulated piping and black rubber insulation exposed to outdoors with aluminum.

.9 Seal black rubber insulation butt joints and seams with black rubber insulation adhesive.

.10 Coat exposed black rubber insulation with two coats of black rubber finish material.

.11 Do not insulate the following piping system components:

.1 Hot water heating piping in radiation cabinets.

.2 Unions, flanges, strainers, expansion joints, flexible piping connectors

.3 Condensate trap assemblies and drip legs.

.4 Chrome plated or stainless steel piping.

.5 Valve bonnets on domestic water systems.

.6 Drains, plugs and caps.

3.3 HOT EQUIPMENT INSULATION APPLICATION

.1 Use rigid glass mineral wool board for flat surfaces and blanket for curved surfaces. Alternate: phenolic board for flat surfaces and curved segments for curved surfaces.

.2 Tightly butt edges and stagger joints. Weld mechanical fastener pins to equipment where necessary.

.3 Cover insulation with 25 mm galvanized hexagonal mesh and 12 mm coat of insulating cement. Finish with a final 12 mm coat of finishing cement and recover with canvas.

3.4 COLD PIPE INSULATION APPLICATION

.1 Insulate 3 m portion of plumbing vents measured from roof outlet back. Do not insulate remaining vent piping.

.2 Insulate 3 m portion of storm sewer piping measured from point of entry at roof. Don not insulate remaining storm piping.

.3 Apply vapor retardant mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Apply adhesive to ends of butt joints and seal joint seams with 100 mm wide strips of joint tape.

.4 Insulate complete system including valves, unions, flanges, strainers, drains, caps and fittings. Cover fittings and valves with equivalent thickness of finishing cement. Cover finishing cement with open mesh glass cloth and vapor retardant adhesive. Seal lap joints with 100% coverage of joint tape and seal the assembly with vapor retardant adhesive. Alternatively, insulate with tightly placed flexible insulation and apply reinforcing membrane embedded in vapor retardant coating and apply PVC fitting covers.

OR

.5 Insulate fittings, valves, flanges and couplings with preformed 2-piece PVC insulation.

.6 Seal black rubber insulation butt joints and seams with black rubber insulation adhesive.

.7 Recover exposed glass mineral wool insulated piping with PVC.

.8 Recover glass mineral wool insulated piping exposed to outdoors with PVC.

.9 Coat exposed black rubber insulation with two coats of black rubber finish material.

3.4 COLD EQUIPMENT INSULATION APPLICATION

.1 Tightly butt edges and stagger joints. Seal joints with 100 mm wide FSK tape.

.2 Cover insulation with 25 mm galvanized hexagonal mesh and 12 mm coat of finishing cement. Finish with a final 12 mm coat of finishing cement and recover with canvas.

3.5 INSULATION TYPE AND THICKNESS SCHEDULE

Insulation Type and Thickness Schedule		
Service Type and Nominal Pipe Diameter (mm)	**Insulation Type**	**Insulation Thickness (mm)**
Domestic Cold water: 38 and smaller 50 and larger	 Cold Pipe Cold Pipe	 12 25
Condenser Water Piping, Indoors: All Sizes	 Cold Pipe	 25
Plumbing Vents: All sizes	 Cold Pipe	 25
Roof Drains	Cold Equipment	25

END OF SECTION

1. GENERAL

1.1 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 1 for requirements pertaining to product options and substitutions.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Comply with requirements of Section 20 00 13.

1.3 RATING OF HANDHELD FIRE EXTINGUISHERS

.1 Provide handheld fire extinguishers rated in accordance with CAN4 S508-M83 and bearing ULC label.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

.1 CEB, CFH, Flag, Fyr Fighter, Pyrene, Silverline, Wilson & Cousins, Incendex, WFR, National Fire Equipment

2.2 HANDHELD FIRE EXTINGUISHERS

.1 Pressurized Dry Chemical:

.1 Description: Multi-purpose Ammonium Phosphate, powder type, heavy duty steel cylinder, baked enamel finish, squeeze grip handle with positive on/off valve, hose, and nozzle, ULC labelled.

.2 Capacity: 2.7 kg.

.3 Capacity Rating: 2A, 2 to 10 BC.

.4 Classification: A, B and C fires.

3. EXECUTION

3.1 INSTALLATION

.1 Install fire extinguisher hanger such that the fire extinguisher is 1.5 m above floor.

.2 Provide extinguishers where shown on drawings and in compliance with the requirements of NFPA 10.

.3 Where exact location is not indicated, mount in location directed by the Contract Administrator.

END OF SECTION

1. GENERAL

1.1 INTENT

.1 This section of the specifications refers to the piping, fittings, valves and all piping specialties and supporting devices to be installed under this contract. Also included are the equipment, valve and commodity identification legends for all piping systems to be installed.

.2 Control valves and other in-line equipment, such as flow meters, pumps, flow control valves, flow switches, pressure switches, solenoid valves, pressure gauges, etc., supplied under Divisions 11 and 25, are to be installed under this Section.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 00 – Closeout Submittals

.3 Section 22 00 20 - Detailed Piping Specifications

.4 Section 22 01 10 - Valves

.5 Section 22 01 90 – Hydrostatic and Pressure Testing

.6 Section 40 03 11 - Instrumentation – Wiring

.7 Section 40 03 12 - Instrumentation – Field Instruments

1.3 REFERENCE STANDARDS

.1 Conform to the following reference standards:

.1 ANSI A13.1, Scheme for the Identification of Piping Systems
.2 ANSI B1.20.1, Pipe Threads, General Purpose
.3 ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
.4 ANSI B16.3, Malleable Iron threaded Fittings Class 150 and 300
.5 ANSI B16.5 Steel Pipe Flanges and Flanged Fittings
.6 ANSI B16.9, Factory-Made Wrought Steel Butt Welding Fittings
.7 ANSI B16.11, Forged Steel Fittings, Socket Welding and Threaded
.8 ANSI B16.12, Cast Iron Threaded Drainage Fittings
.9 ANSIB16.15, Pipe Flanges and Flanged Fittings, Classes 150 and 300
.10 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings
.11 ANSI B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
.12 ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes
.13 ASME B31.1, Power Piping
.14 ASME B31.3, Process Piping
.15 ASME B31.9, Building Services Piping
.16 ANSI B32, Solder Metal

.17 ANSI B36.10M, Welded and Seamless Wrought Steel Pipe
.18 ANSI B36.19M, Stainless Steel Pipe
.19 ASME Section IX, Boiler and Pressure Vessel Code; Welding and Brazing Requirements
.20 ASTM A47, Malleable Iron Castings
.21 ASTM A53, Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless
.22 ASTM A74, Cast Iron Soil Pipe and Fittings
.23 ASTM A105/A105M, Forgings, Carbon Steel, for Piping Components
.24 ASTM A106, Seamless Carbon Steel Pipe for High Temperature Service
.25 ASTM A126, Grey-Iron Castings for Valves, Flanges, and Pipe Fittings
.26 ASTM A135, Electric-Resistance-Welded Steel Pipe
.27 ASTM A139, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over)
.28 ASTM A167, Stainless Steel and Heat-Resisting Chromium- Nickel Steel Plate
.29 ASTM A181/181M, Forgings, Carbon Steel, for General Purpose Piping
.30 ASTM A182/182M, Forged or Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
.31 ASTM A193/193M, Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
.32 ASTM A194/194M, Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
.33 ASTM A197, Cupola Malleable Iron
.34 ASTM A234/A234M, Pipe Fittings of Wrought Carbon Steel and Alloy steel for Moderate and Elevated Temperatures
.35 ASTM A240, Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
.36 ASTM A269, Seamless and Welded Austenitic Stainless Steel Tubing for General Service
.37 ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes
.38 ASTM A307, Carbon steel Bolts and Studs, 60,000 psi Tensile Strength
.39 ASTM A312/312M, Seamless and Welded Austenitic Stainless Steel Pipe
.40 ASTM A320/320M, Alloy Steel Bolting Materials for Low-Temperature Service
.41 ASTM A403/A403M, Wrought Austenitic Stainless Steel Piping Fittings
.42 ASTM A409/A409M, Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service
.43 ATSM A480/A480M, General Requirements for Flat-Rolled Stainless for Heat-Resisting Steel Plate, Sheet and Strip
.44 ASTM A536, Ductile Iron Castings
.45 ASTM A563, Carbon and Alloy Steel Nuts
.46 ASTM A570/A570M, Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
.47 ASTM A774/A744M, As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
.48 ASTM A778, Welded, Unannealed Austenitic Stainless Steel Tubular Products
.49 ASTM B88, Seamless Copper Water Tube
.50 ASTM C76, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
.51 ASTM C564, Rubber Gaskets for Cast Iron Soil Pipe and Fittings
.52 ASTM D638, Test Method for Tensile Properties of Plastics
.53 ASTM D792, Test Method for Specific Gravity and Density of Plastics by Displacement
.54 ASTM D1248, Polyethylene Plastics Moulding and Extrusion Materials

.55 ASTM D1457, PTFE Moulding and Extrusion Materials
.56 ASTM D1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
.57 ASTM D1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
.58 ASTM D2241, Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
.59 ASTM D2466, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
.60 ASTM D2467, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
.61 ASTM D2513, Thermoplastic Gas Pressure Pipe, Tubing and Fittings
.62 ASTM D2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
.63 ASTM D2665, Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
.64 ASTM D2996, Filament-Wound Reinforced Thermosetting Resin Pipe
.65 ASTM D3212, Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals
.66 ASTM D3261, Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Fittings
.67 AST D4101, Propylene Plastic Injection and Extrusion Materials
.68 ASTM D4174, Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems
.69 ASTM F441, Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
.70 ASTM F894, Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
.71 AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
.72 AWWA C110, Ductile-Iron and Grey-Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids
.73 AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Grey-Iron Pipe and Fittings
.74 AWWA C115, Flanged Ductile-Iron and Grey-Iron Pipe with Threaded Flanges
.75 AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Moulds or Sand-Lined Moulds, for Water and Other Liquids
.76 AWWA C200, Steel Water Pipe, 6 Inches and Larger
.77 AWWA C203, Coal Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied
.78 AWWA C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 Inches through 144 Inches
.79 AWWA C206, Field Welding of Steel Water Pipe
.80 AWWA C207, Steel Pipe Flanges for Waterworks Services – Sizes 4 Inch Through 144 Inch
.81 AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings
.82 AWWA C209, Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines
.83 AWWA C210, Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe
.84 AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines
.85 AWWA C301, Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids

.86 AWWA C303, Reinforced Concrete Pressure Pipe – Steel Cylinder Type, Pretensioned, for Water and Other Liquids
.87 AWWA C600, Installation of Ductile-Iron Water Mains and their Appurtenances
.88 AWWA C606, Grooved and Shouldered Joints
.89 AWWA C651, Disinfecting Water Mains
.90 AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water
.91 AWWA M11; Steel Pipe – A Guide for Design and Installation
.92 CGA, Canadian Gas Association Standards
.93 CAN/CGA B105 – Installation Code for Digester Gas Systems
.94 CISPI 301, Specification Data for Hubless Cast Iron Sanitary System with No-Hub Pipe and Fittings
.95 CPC, Canadian Plumbing Code
.96 CSA B52, Mechanical Refrigeration Code
.97 CSA B64 Series CSA Standards on Vacuum Breakers and Backflow
.98 CAN3-B70, Cast Iron Soil Pipe, Fittings, and Means of Joining
.99 CSA B137.3, Rigid PVC Pipe for Pressure Applications
.100 CSA B139, Installation Code for Oil Burning Equipment
.101 CSA B140.0 General Requirements for Oil Burning Equipment
.102 CSA B158.1 Cast Brass Solder Joint Drainage, Waste and Vent Fittings
.103 CAN3-B181.2 PVC Drain, Waste and Vent Pipe and Pipe Fittings
.104 CSA CAN3-Z299.3, Quality Verification Program Requirements
.105 CSA Z662 Oil and Gas Pipeline Systems
.106 CSA B242 Groove and Shoulder Type Mechanical Pipe Couplings
.107 EJMA STDS, Standards of Expansion Joint Manufacturers' Association, Edition No. 6
.108 Fluid Sealing Association Technical Handbook, Rubber Expansion Joint Division
.109 FEDSPEC, L-C530B(1), Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
.110 MIL-H-13528B, Hydrochloric Acid, Inhibited, Rust Removing
.111 MIL-S-8660C, Silicone Compound
.112 MIL-STD-810C, Environmental Test Methods
.113 MSS SP25, Standard Marking System for Valves, Fittings, Flanges and Unions
.114 MSS SP43, Wrought Stainless Steel Butt Welding Fittings
.115 SAE J1227, Assessing Cleanliness of Hydraulic Fluid Power Components and Systems
.116 SSPC-P3, Canadian Government Standards Board
.117 SSPPC-SP6, Canadian Government Standards Board
.118 SSPC-SP10, Canadian Government Standards Board
.119 Plumbing and Drainage Regulations of Province of Saskatchewan
.120 Gas Protection Regulations of the Province of Saskatchewan
.121 Pressure Vessel Act of the Province of Saskatchewan
.122 The American Society of Mechanical Engineers. (ASME)

.1 ASME Boiler and Pressure Vessel Code, Part I – Power Boilers
.2 ASME Boiler and Pressure Vessel Code, Part IV – Heating Boilers
.3 ASME Boiler and Pressure Vessel Code, Part VIII – Pressure Vessels
.4 ASME Boiler and Pressure Vessel Code, Part IX – Welding and Brazing Qualifications

.123 The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
.124 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
.125 Department of Environment of the Province of Saskatchewan
.126 Air-Conditioning and Refrigeration Institute (ARI)
.127 National Fire Protection Association (NFPA)
.128 Air Movement and Control Association (AMCA)
.129 Canadian Gas Association

.1 CAN/CGA B149.1 Natural Gas Installation Code
.2 CAN/CGA-B149.2 Propane Installation Code

.130 National Building Code
.131 National Sanitation Foundation (NSF)
.132 American Petroleum Institute (API)
.133 CSA B214-07 Installation code for hydronic heating systems

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data.

.2 Shop drawings and product data to include the following:

.1 Performance curves, which include differential head, efficiency, water NPSHR, and brake horsepower (where applicable).
.2 Outline and arrangement drawings.
.3 Cross-section drawings.
.4 Materials of construction.

1.5 UNIFORMITY OF EQUIPMENT

.1 All valves, gauges and other equipment to be supplied by one manufacturer throughout to the extent practical. Variations will be permitted only where the major supplier cannot supply a particular piece of equipment as specified.

1.6 DRAWINGS AND DESIGN

.1 The drawings are intended to show the major details of the mechanical work but it is the Contractor's responsibility to examine the electrical, mechanical, structural and architectural drawings before beginning the work and report to the Contract Administrator any discrepancies or interferences which may occur.

1.7 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into the manual specified in Section 01 78 00 – Closeout Submittals.

.2 Include the reviewed tag lists.

1.8 PIPE MATERIALS – GENERAL

.1 All pipe materials to be new, free from defects and conforming to applicable reference standards.

.2 All materials, linings and coatings in contact with potable water to be NSF approved for potable water.

.3 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

1.9 PIPE SIZES

.1 Where the pipe size is not specified, provide pipes with the sizes required by the Plumbing Code. Small piping not described by the Plumbing Code or otherwise specified herein shall be 12 mm nominal diameter.

1.10 JOINTS – GENERAL

.1 Connect piping using joints not readily disassembled only where shown and where not otherwise specified. Provide joints which maybe disassembled at the minimum, within 1.0 metre of any connection to equipment, on both sides of structural penetrations, within 0.6 metres of all threaded end valves, and at the spacing specified in the detailed piping specification sheets.

.2 For carbon steel piping less than 75 mm in diameter, butt-weld or use threaded couplings. Use unions where disassembly is required.

.3 For steel piping equal to or greater than 75 mm in diameter, where not specified or shown otherwise, butt-weld according to ASME Boiler and Pressure Vessel Code or furnish slip-on flanges, conforming to ANSI B16.5, Class 150. Unless indicated otherwise on the drawings or detail specifications, where disassembly is required, use flanges.

.4 For stainless steel tubing use stainless steel compression fittings.

.5 For schedule rated stainless steel pipe smaller than 75 mm in diameter, socket-weld pipe. Where disassembly is required, use threaded unions.

.6 For thin wall or schedule rated stainless steel pipe equal to or greater than 75 mm in diameter, butt-weld pipe unless otherwise shown or specified.

.7 For copper or brass piping, use soldered couplings. Where disassembly is required, use compression unions.

.8 For ductile iron piping, where not shown or otherwise specified, and for other piping where specified or shown, use grooved joints in accordance with AWWA C606.

.9 Where not shown or otherwise specified, use solvent weld joints for PVC and FRP piping. Provide flanges or unions where disassembly is required.

1.11 TAGGING

.1 Provide each piece of equipment with a tag stamped or engraved with the appropriate equipment number, as listed in this Specification.

.2 Tags to be 20mm high, 75mm long, and 1.5mm thick Lamecoid with 10 mm high alphanumeric characters, Helvetica font, reverse engraved. Characters to be white on coloured background. Background colour to be red.

.3 The code lettering and number system shall be as shown on the P & I drawings or as directed by the Engineer.

.4 Affix tags to equipment securely.

2. PRODUCTS

2.1 PIPE, FITTINGS AND VALVES

.1 All, fittings and standard valves to be in accordance with the line code sheet accompanying this section. All piping materials to be in accordance with the line code sheet accompanying section 22 00 20.

2.2 FLANGES

.1 Unless otherwise noted, make flanges on steel pipe Class 150, conforming to ANSI B16.5. Companion flanges for connection to cast iron or ductile iron equipment flanges shall be refaced to be flush with the companion flange.

.2 Make flanges on stainless steel piping stainless steel slip-on, rolled-angle Van-Stonetype, with a stainless steel back-up ring drilled to ANSI B 16.1, Class 125. Make the angle ring thickness equal or greater than the pipe or fitting to which it is welded. For digester gas services, make the flanges Lap-joint type with galvanized steel Lap-joint flange and in accordance with CGA B105. For instrument air services, make the flanges Lap-joint type with a stainless steel Lap-joint flange.

.3 Provide Class 125 flanges on cast or ductile pipe, conforming to ANSI B 16. 1.

.4 General requirements for flanges are as follows:

.1 Compatible flanges for mating to equipment or valves.
.2 Provide flat-faced flanges on each side of butterfly valves.
.3 For steel piping, provide weld neck flanges on both sides of wafer or lug body valves.

.5 Do not use slip-on flanges that are attached to a pipe by means of set screws and gaskets.

2.3 LINK SEALS

.1 Seal pipes passing through concrete walls as indicated on drawings, in a watertight manner, with link type expanding rubber seals as manufactured by the Thunderline Corporation.

.2 Link seals shall have EPDM seal element, composite pressure plates, and steel bolts with zinc chromate treatment.

.3 Size to suit cored hole or sleeved hole as required.

.4 Support pipe on either side of seal so that seal is not load bearing.

2.4 DIELECTRIC COUPLINGS

.1 Wherever pipes of dissimilar metals are joined use dielectric couplings.

.2 Use insulating unions for pipe sizes 50 mm and smaller and insulating flanges for pipe sizes larger than 50 mm.

2.5 UNIONS

.1 Provide unions at all locations for all pipe materials so that the Operator can easily perform required maintenance of all equipment.

2.6 SOLDERED COUPLINGS

.1 Soldered couplings for copper pipe conform to ANSI B16.26. Solder to be lead free conforming to ASTM B32 and the Plumbing Code.

2.7 THREADED COUPLINGS

.1 Make screwed joints using American Standard threads to ANSI B1.20.1 .

.2 Use paste as thread lubricant for threaded joints, Loctite or approved equal.

.3 Conform to ASTM Al82 or ASTM A276, Class 150, for threaded connections to stainless steel pipe, threadolets to be shop welded to the pipe at the locations specified.

.4 Provide threaded-end to flanged-end adaptors where required to connect to flanges.

2.8 COMPRESSION COUPLINGS

.1 Furnish compression couplings for stainless steel tubing of the same material as the pipe, capable of withstanding the maximum pressure to which the pipe is subjected.

.2 Furnish compression couplings for copper and brass tubing of copper, suitable for the maximum pressure of the pipe, conforming to ANSI B16.26.

2.9 GROOVED JOINT COUPLINGS

.1 Fabricate grooved joint couplings of ductile iron to ASTM A536, and in accordance with AWWA C606. Provide cut or rolled grooves in pipe and fittings in accordance with AWWA C606. Rolled grooves and roll-groove type joints are not acceptable.

.2 Steel Pipe: Use flexible style couplings for all buried service pipe, all pipe greater than 300 mm in diameter, for pipe less than 300 mm in diameter in rack mounted piping assemblies, and for grooved joints adjacent to pump or blower suction and discharge where grooved joints are used for noise and vibration control. Use rigid style couplings in all other applications.

.3 Where grooved joint piping systems connect to equipment or to flanged valves, meters, or other sensing devices; use grooved joint flanges or flange adapters. Acceptable products are: Tyler Groove to Flange Fittings or Victaulic Flange adaptors. Where the Contractor chooses to use grooved joint flanges rather than the indicated adapters, piping modifications required to suit this change are the responsibility of the Contractor. Make full allowance for piping disassembly and access to the face of equipment.

.4 All couplings to be internally and externally epoxy coated.

2.10 FLEXIBLE COUPLINGS

.1 Flexible Couplings for non-buried to be Brico D-0-L

.1 Stainless steel construction with stainless steel bolts, nuts and washers.
.2 Gaskets: fabricated of material suitable to the service conditions.

2.11 FITTINGS

.1 For steel pipelines 75 mm in diameter or greater, fittings to conform to ANSI B16.9, ANSI B16.11 or ANSI B16.5. Provide fittings with a wall thickness equal to or greater than the pipe. In steel pipelines less than 75 mm in diameter provide threaded malleable iron fittings, conforming to ANSI B16.3.

.2 Provide long radius steel grooved-joint fittings conforming to ANSI B16.9 in steel grooved-joint pipeline systems. Grooved joint adapters may be welded to fitting ends; dimension and cut or roll the groove of the adapter in accordance with the coupling manufacturer's recommendations; materials and inside diameter to be the same as the pipe; grind the interior weld smooth and meet the lining manufacturer's recommendations.

.3 For steel grooved-joint pipe of diameters of 150 mm and less, the Contractor may provide ductile iron grooved-joint fittings which have an outside diameter equal to the steel pipe diameter. Provide ductile iron to ASTM A536, dimensioned to 1.5 diameter radius bends, and cut grooving dimensions to AWWA C606 EPS dimensions. The lining and coating of the ductile iron fittings must equal the lining and coating of the steel pipeline system.

.4 Standard radius elbows to dimensions of ANSI B16.5 may be provided on clean water grooved-joint piping systems only.

.5 Provide butt welding fittings in stainless steel pipelines less than 75 mm of the same class as the pipe, conforming to ASTM A403 and ANSI B16.11. Provide socket welding fittings in stainless steel pipelines less than 75 mm to Cl. 3000, same material as the pipe, and ANSI B16.1 1. Fabricate fittings in stainless steel pipelines equal to or greater than 75 mm in diameter using similar materials and classes as the pipe and conform to ASTM A774.

.6 Provide fittings in flanged ductile iron pipelines that conform to ANSI B16.1 and in grooved end or mechanical joint ductile iron pipelines to AWWA C110.

.7 Provide ductile iron fittings in PVC pipelines that conform to AWWA C110 or provide PVC to CSA B137.3, of the same material and class as the pipe.

.8 Provide fittings in FRP pipelines of the same material and class as the pipe.

.9 Provide copper fittings in copper pipelines conforming to ANSI B16.26.

.10 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise.

.11 Provide concentric reducers in vertical lines unless indicated otherwise.

.12 Provide long radius elbows unless otherwise shown. Provide smooth flow carbon or stainless steel elbows 350 mm and less, to ANSI B16.9. Provide mitred elbows greater than 350 mm, to AWWA C208 unless otherwise shown or specified. Use 3-piece construction unless otherwise shown or specified.

.13 Provide fittings in concrete cylinder pipe fabricated from metal plate, cement lined and coated, and in accordance with AWWA C301. Dimensions to AWWA C208.

2.12 GASKETS

.1 For flat faced flanges, use full-face gaskets. For raised-face flanges, use ring type gaskets. Conform to ASTM B16.21.

.2 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosivity of the fluid conveyed in the pipeline. Refer to detailed pipe specifications for recommended gasket material. Material designations used in the detailed pipe specification sheets are as follows:

.1 EPDM: ethylene-propylene-diene-terpolymer 70 durometer.
.2 Bl. Neoprene: neoprene (black) 70 durometer.
.3 Nitrile: nitrile (Buna N).
.4 SBR: Styrene-butadiene (red).
.5 Natural rubber: natural rubber.
.6 Compressed synthetic fibres (Kevlar): ASTM F104 (F7712400), and neoprene binder: 1.7 MPa (ASTM F152), 0.2 mL/h Leakage Fuel A (ASTM F37).
.7 Compressed synthetic fibres (Kevlar): ASTM F104 (F712400) and SBR binder: 1.7 MPa (ASTM F1 52), 0.1 mL/h Leakage Fuel A (ASTM F37).
.8 Gylon - Type 1: Garlock Style 3500,1.35 MPa (ASTM F152), 0.22 mL/h Leakage Fuel A (ASTM F37).
.9 Gylon-Type2: Garlock Style 3510,1.35 MPa (ASTM F152), 0.04 mL/h Leakage Fuel A (ASTM F37).
.10 CPE - Chlorinated Polyethylene.

.3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:

.1 75 to 250 mm pipe diameter; 1.6 mm thick.

.2 Greater than 250 mm pipe diameter; 3.2 mm. thick.

.4 Unless otherwise specified, minimum gasket material thickness for raised face ring gaskets:

.1 75 to 100 mm pipe diameter; 1.6 mm thick.
.2 Greater than 100 mm. pipe diameter; 3.2 mm thick.

.5 Grooved joint gasket materials to be as recommended by the manufacturer for the service conditions indicated. Unless otherwise specified, provide flush seal type gaskets for all grooved joint systems. Acceptable products: Gustin-Bacon Rigigrip, Victaulic Flush-Seal.

2.13 BOLTS AND NUTS

.1 Provide hex head bolts and nuts. Threads to be ANSI B1.1, standard coarse thread series.
.2 For general interior service, use bolts and nuts conforming to ASTM A307, Grade A; nuts conforming to ASTM A563, Gr.A.

.3 For exposed (exterior), submerged, buried, installed below the main floor slab and concrete encased service, provide stainless steel bolts, nuts and washers; bolts conforming to ASTM A193, Gr.B8, C1.1; nuts conforming to ASTM A194, Gr.8.

.4 Provide hot dip galvanized bolts, nuts and washers for use with hot dip galvanized Van Stone flange back-up rings and Lap-joint flange back-up rings.

.5 Provide hex nuts equal to or less than 25 mm. Greater than 25 mm, provide heavy hex.

2.14 ANCHOR BOLTS

.1 Provide hot dip galvanized, L – type anchor bolts, nuts and washers for use with concrete support blocks.

.2 Use bolts and nuts conforming to ASTM A307, Grade A; nuts conforming to ASTM A563, Grade A.

.3 Refer to the standard drawings at the end of this section.

2.15 EPOXY COATING (INTERIOR/EXTERIOR PIPING & VALVE SURFACES)

.1 General

.1 All coatings in contact with potable water shall be to AWWA C210, ANSI/NSF 60/61 suitable for use in potable water applications.
.2 All coatings shall be factory applied by the fitting, piping or valve manufacturer or by a specialized coating firm approved by the Contract Administrator.
.3 Coat all non-galvanized/non-stainless steel surfaces in contact with water.

.2 Coating Materials and Applications

.1 Coating Material: The coating material shall be a two component, epoxy liquid coating suitable for use in potable water applications.
.2 Application: The coating shall be cold applied and holiday free in accordance with the coating manufacturer's specifications.

.3 Surface Preparations

.1 All surfaces shall be blast cleaned to SSPC-SP5 prior to and within 4 hours of coating. Newly cast objects need not to be sandblasted if not contaminated with soil, oil, grease etc. and if coating takes place within 4 hours after casting.

.4 Field Applied Coatings

.1 Apply to damaged areas of shop coated surfaces and at field welds.
.2 Clean and prepare surfaces in accordance with the manufacturer's recommendations.
.3 Repair coating with an epoxy compatible with the factory-applied epoxy and finish in accordance with the coating manufacturers specifications.

.5 Inspection

.1 The coating shall be pinhole free.
.2 The City reserves the right to obtain independent coating testing.
.3 The cost of independent coating testing shall be born by the City unless the inspection was requested by the Contractor.
.4 If the independent test shows that the coating is unacceptable, the Contractor shall bear the full cost of all testing and reapplication to the satisfaction of the City.

.6 Color Schedule

.1 All piping, valves, and equipment shall be color coded and the finish colors shall be as shown on the color schedule in Section 09 91 00.08 or as directed by the Engineer.

.7 Acceptable product:

.1 Devoe BAR-RUST 233H (NSF approved) Multi-Purpose Epoxy Coating, DFT 12 - 16 mils
.2 Or approved alternate

2.16 FIELD APPLIED COATING AND WRAPPING

.1 Buried steel piping shall have an external protective wrapping to protect against corrosion. The wrapping shall consist of a primer followed by a polyken tape covering and then a polyethylene rock shield. The system of primer and tape shall conform to AWWA C209.

.2 The tape shall be a polyken tape with butyl rubber backing.

.3 Primer shall have a base of rubber and synthetic resins, compatible with tape, and suitable for hand application.

.4 The rock shield shall be black polyethylene, 40-mil thickness, supplied in rolls 1050-mm wide, Renfrew 350-40 or as approved.

.5 Buried steel flanges shall have an external protective wrapping to protect against corrosion. The wrapping shall consist of a primer followed by a Denso tape covering.

2.17 GALVANIZING

.1 Where piping is to be galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m^2.

2.18 RPVC CONDUIT

.1 Tubing shall be installed in RPVC conduit where indicated on Contract Drawings.

.2 Tubing of 10 mm diameter and smaller is to be installed in 25 mm diameter RPVC conduit complete with long radius elbows.

.3 Tubing of 12 mm diameter to be installed in 50 mm diameter RPVC conduit complete with long radius elbows.

2.19 TRACER WIRE

.1 Buried non-metallic piping shall be installed with insulated tracer wire.

.2 Insulated tracer wire; 2.0mm (14 gauge) shall be placed above the pipeline and directly over the centre of the pipeline. The Contractor must ensure that the tracer wire is not cut, scraped, or nicked during installation. Termination points shall be installed on Pipeline Warning Sign Posts at approximately 2 km spacing.

.3 The Contractor shall test and the Engineer shall check the tracer wire. It shall be the Contractor's responsibility to locate and repair any malfunctions discovered by either the Contractor or the Engineer.

2.20 PIPE HANGERS AND SUPPORTS

.1 General:

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 1983 and MSS-SP58-1983.
.2 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
.3 Dielectrically isolate all piping from dissimilar metal supports.

.2 Upper Attachments:

.1 Concrete:

.1 Inserts for cast-in-place concrete: galvanized steel wedge to MSS-SP58-1983, type 18. ULC listed for pipe 20 mm size through 200 mm.
.1 Acceptable product: Anvil Fig. 281; Myatt.

.2 Carbon steel plate with clevis, for surface mount - malleable iron socket, expansion case and bolt. Minimum two expansion cases and bolts for each hanger.
.1 Acceptable product: Anvil - Fig. 49, Socket Fig. 290, Expansion Case Fig. 117; Myatt.

.2 Steel Beam (bottom flange):

.1 Cold piping 50 mm size or smaller: malleable iron C clamp to MSS-SP58-198 type 19, ULC listed.
.1 Acceptable product: Anvil Fig. 61; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: malleable iron beam clamp to MSS-SP58-1983 type 28 or 29,
ULC listed.
.1 Acceptable product: Anvil Fig. 229; Myatt.

.3 Steel Beam (top):

.1 Cold piping 50 mm size or smaller: malleable iron "top of beam" clamp to MSS-SP58-1983 type 19, ULC listed.
.1 Acceptable product: Anvil Fig. 61; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping:
steel jaw, hook rod with nut, spring washer and plain
washer, to MSS-SP58-1983 type 25, ULC listed.
.1 Acceptable product: Anvil Fig. 227: Myatt.

.4 Steel Joist:

.1 Cold piping 50 mm size and smaller: steel washer
plate with double locking nuts.
.1 Acceptable product: Anvil Fig. 60; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.
.1 Acceptable product: Anvil - washer plate Fig. 60, clevis Fig. 66, socket Fig. 290, Myatt.

.5 Steel Channel or Angle (bottom):

.1 Cold piping 50 mm size and smaller: malleable iron C clamp to MSS-Sp58-1983 type 23, ULC listed.
.1 Acceptable product: Anvil Fig. 86; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: universal channel clamp, ULC listed.

.1 Acceptable product: Anvil 226; Myatt.

.6 Steel Channel or Angle (top):

.1 Cold piping 50 mm size or smaller: malleable iron "top of beam" C clamp to MSS-SP58-1983 type 19 ULC listed.
.1 Acceptable product: Anvil Fig. 61; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP58-1983 type 25, ULC listed.
.1 Acceptable product: Anvil Fig. 227: Myatt.

.3 Middle Attachment (rod):
.1 Carbon steel threaded rod, electro-galvanized for finish.
.1 Acceptable product: Anvil Fig. 146: Myatt.

.4 Pipe Attachment:
.1 Cold piping, steel or cast iron: hot piping, steel with less than 25 mm horizontal movement: hot piping, steel with more than 300 mm middle attachment rod length: adjustable clevis to MSS-SP58-1983 type 1, ULC listed.
.1 Acceptable product: Anvil Fig. 260; Myatt.

.2 Cold piping, hot copper with less than 25 mm horizontal movement; hot copper with more than 300 mm middle attachment rod length: adjustable clevis to MSS-SP58-1983 type 1, copper plated.
.1 Acceptable product: Anvil Fig. CT-65; Myatt.

.3 Suspended hot piping, steel and copper with horizontal movement in excess of 25 mm; hot steel with middle attachment rod 300 mm or less: pipe roller to MSS-1983 type 43.
.1 Acceptable product: Anvil Fig. 181; Myatt.

.4 Bottom supported hot piping, steel or copper: pipe roller stand to MSS-SP58-1983 type 45.
.1 Acceptable product: Anvil Fig. 271; Myatt.

.7 Riser Clamps:

.1 Steel or cast iron pipe: galvanized carbon steel to MSS-SP58-1983 type 42, ULC listed.
.1 Acceptable product: Anvil Fig. 261; Myatt.

.2 Copper pipe: carbon steel copper finished to MSS-SP58-1983 type 42.
.1 Acceptable product: Anvil Fig. CT-121; Myatt.

.8 Strut Mounted (galvanized carbon steel):

.1 Copper piping: cushion clamp c/w thermoplastic rubber.
.1 Acceptable product: Anvil PS1400; Hydra-Zorb.

.9 Saddles and Shields:

.1 Cold piping 30 mm and larger: protection shield with high density insulation under shield with interrupted vapour barrier.
.1 Acceptable product: Anvil Fig. 167; Myatt.

.2 Hot piping 30 mm size and larger: protective saddle with insulation under saddle.
.1 Acceptable product: Anvil Fig. 160 to 166; Myatt.

2.21 DUCT HANGERS AND SUPPORTS

.1 Hangers: Galvanized steel band iron or rolled angle and 10 mm rods.

.2 Wall Supports: Galvanized steel band iron or fabricated angle bracket.

.3 Vertical Support at Floor: Rolled angle.

2.22 RACK AND TRAPEZE SUPPORTS

.1 Provide steel trapeze and pipe rack components having a minimum thickness of 2.7 mm (12 gauge) with a maximum deflection of 1/240 of the span unless otherwise noted.

.2 Provide trapeze pipe support cross members and general fittings as required.

.3 Approved Supplier:

.1 Unistrut or approved equal

2.23 FINISHES ON HANGER RODS, HANGERS AND SUPPORTS

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

2.24 INSTRUMENT AIR CONNECTIONS

.1 Provide instrument air connections to each instrument with a run of 6 mm nylon tubing from the nearest instrument air header to within close proximity of each device requiring instrument air.

.2 Terminate each tubing run with a 12 mm ball valve (stainless steel) within 1500 mm horizontal distance of the device and 1,500 mm off the floor. Group multiple valves neatly together with a common orientation.

.3 Provide a vertical riser connection at the header to avoid condensate entrainment. From the top of the riser, slope the tubing generally down to the device.

2.25 QUICK DISCONNECTS

.1 Provide quick disconnects which are not disconnectable under pressure. Unless otherwise shown or specified, provide products listed below.

.2 For air service, acceptable products are:

.1 Dixon Air King
.2 Tomco, 12 mm diameter. Tomco, THK.

.3 For water service, sizes as shown. Acceptable products are:

.1 For 25 mm or less diameter hose, two lug, malleable iron, female NPT: Dixon Air King.
.2 For 38 mm and 50 mm diameter hose, two four lug, malleable iron, female NPT: New Line Dixon Air King.
.3 For 75 and 100 mm diameter or greater; quick-acting, dual clip: Rite-pro, Dixon.

2.26 FLUSHING CONNECTIONS

.1 Provide flushing connections on all piping for the conveyance of sludge, scum, grit or other liquid containing solids greater than 0.5 percent. Locate flushing connections adjacent to all isolation valves, on dead end branches, at tees and 90 degree elbows, and at intermediate locations which limit the distance between flushing connections to less than 30 metres. Show flushing connections on piping submittals.

.2 Allow for 5 – 12.5 mm sample ports tapped into 150 to 300 mm pipes. Engineer will provide location during commissioning.

2.27 PURGE CONNECTIONS

.1 Provide purge connections on all gas lines. Locate adjacent to both sides of all isolation valves and spectacle flanges, and at any other locations shown in the drawings. Purge points shall be a minimum of 20 mm NPS pipe, fitted with a shut off valve which shall be capped.

2.28 MECHANICAL BRANCH CONNECTIONS

.1 Provide mechanical branch connections as required for flushing connections and pipe tappings. Provide branch connection recommended by the manufacturer for the service and pipe installed. Acceptable products are:

.1 Gruvlock Clamp T
.2 Ford Service Saddles (F/FS)
.3 Victaulic Mechanical T

2.29 DRAIN VALVES

.1 Locate at all low points and section isolating valves unless otherwise specified.

.2 Minimum 20 mm size unless otherwise specified: straight pattern bronze with hose end male thread and complete with cap and chain.

2.30 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40°C for open housing and 50°C for drip proof housing, and operate at 1200 or 1800 r/min unless otherwise specified.

.3 Motors shall have ball or roller type bearings.

.4 Provide grease lubrication fittings on motors with frame sizes 254T and larger.

.5 Refer to electrical specification for voltage, phase and cycle.

2.31 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW: standard adjustable pitch sheaves, having +/- 10% range. Use mid-position of range for specified r/min.

.4 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.5 Motor slide rail adjustment plates to allow for centre line adjustment.

2.32 GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame.
.2 Minimum 1.2 mm sheet metal tops and bottoms.
.3 38 mm diameter holes on both shaft centers for insertion of tachometer.
.4 removable for servicing.
.5 Install guards to allow movement of motors for adjusting belt tension.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
.2 Securely fasten in place.
.3 Removable for servicing.

.5 Unprotected inlets and outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.
.2 Net free area of guard: not less than 80% of fan openings.
.3 Securely fasten in place.
.4 Removable for servicing.

2.33 SPARE PARTS AND SPECIAL TOOLS

.1 As specified in the contract as follows:

.1 One set of belts for each piece of machinery.
.2 One filter cartridge or set of filter media for each filter or filter bank in addition to the final operating set.

.2 Provide one set of special tools required to service equipment as recommended by the equipment manufacturer.

2.34 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting, and servicing.

.2 Flush mounted 600 mm x 600 mm for body entry and maximum size possible to 300 mm x 300 mm for hand entry unless otherwise noted. Doors to open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiles or marble surfaces: use stainless steel with brushed satin or polished finish as directed by the Contract Administrator.
.2 remaining areas: use prime coated steel.

.4 Installation:

.1 Locate such that all concealed items are accessible.
.2 Locate such that hand or body entry is achieved.
.3 Installation is specified in applicable sections.

2.35 FLASHING

.1 Steel Flashing: 0.55 mm galvanized steel.

.2 Lead Flashing: sheet lead, as follows:

.1 For Waterproofing: 25 kg/m^2.
.2 For Soundproofing: 5 kg/m^2.
.3 Lead Sheet Size:

.1 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.
.2 Floor Drains: minimum 920 x 920 mm and as specified.
.3 Other Locations: as specified.

.3 Safes: 25 kg/m^2 sheet lead or 200 micrometre neoprene.

.4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.36 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting, and servicing of all systems and equipment during regular work hours, prior to acceptance.

2.37 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the engineer of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

3. EXECUTION

3.1 EXAMINATION

.1 Examine areas where work is to be performed for:

.1 Anything that affects execution and quality of work.
.2 Piping clearances.

3.2 VALVES AND EQUIPMENT IDENTIFICATION

.1 Tagging:

.1 See Section 1.11.

.2 The drawings designate the size and line service specification of all pipe, fittings, valves and equipment to be supplied by the Contractor in the following manner.

.3 Valve Identification Symbols

.1 Valve Identity Symbols

Symbol	**Valve Type**
ARV	Air Release Valve
BAV	Ball Valve
BBV	Block and Bleed Valve
BPV	Back Pressure Valve
BUV	Butterfly Valve
BV	Block Valve
CAV	Combination Air Vacuum
CHV	Check Valve
DCVA	Double Check Valve Assembly
FCV	Flow Control Valve
GAV	Gate Valve
GLV	Globe Valve
NEV	Needle Valve
PRV	Pressure Reducing Valve
PSV	Pressure Sustaining, Pressure Relief Valve
SV	Solenoid Valve

.2 Valve Marking
Each valve to bear the manufacturer's name or trademark and reference symbol to indicate the service conditions for which the manufacturer guarantees the valve. The marking to be in accordance with MSS-SP-25.

.3 Manual Valve Actuators
.1 Actuators for valves to be as follows:

Type of Valve	Size	Valve Actuator
Gate Valve	250 mm & smaller	Handwheels
Globe Valve	250 mm & smaller	Handwheels
Butterfly Valves	100 mm & smaller	Lever operated
	150 mm & larger	Gear operated
Ball Valves	100 mm & smaller	Lever operated
Plug Valves	100 mm & smaller	Lever operated
	150 mm & larger	Gear Operated

.4 Valve operators to turn in a counter-clockwise direction to open unless otherwise indicated on the drawings.

.4 Equipment Identification

.1 Processes

Symbol	Equipment
AC	Air Compressor
B	Blower
EXP	Expansion Joint
FI	Flow Indicator
M	Mixer
PI	Pressure Indicator
P	Pump
SK	Skimmer
STR	Strainer
TK	Tank

.2 Plumbing

Symbol	Equipment
CO	Cleanout
DWH	Domestic Water Heater
ED	Equipment Drain
FD	Floor Drain
FFD	Funnel Floor Drain
FSL	Flow Switch
HB	Hose Bibb
HD	Hub Drain
NFHB	No Freeze Hose Bib
PTK	Pressure Tank
PS	Pressure Switch
RD	Roof Drain

.3 Heating, Ventilation, and Air Conditioning

Symbol	Equipment
B	Boiler
BDD	Back Draft Damper
CC	Cooling Coil
CF	Ceiling Fan
CU	Condensing Unit
DM	Damper
EF	Exhaust Fan
ET	Expansion Tank
FC	Fan Coil Unit
FF	Force Flow Unit
GC	Glycol Fill Tank
L	Louvre
P	Pump
SF	Supply Fan
T	Thermostat
UH	Unit Heater

3.3 PIPING INSTALLATION

.1 General:

.1 Conform to requirements of ANSI B31 code for pressure piping.
.2 Install straight, parallel and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes.
.3 Install groups of piping parallel to each other, spaced to permit application of insulation (when required), identification, and service access, on hangers.
.4 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
.5 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
.6 Install flanged or welded nozzles, branch connections, welding outlets, adapters and taps, true and faced at right angles to the axis of the pipe. Do not extend connection inside of pipe.
.7 Make pipe ends round and true, suitable for weld connection.
.8 Prepare pipe ends in accordance with ANSI B16.25 for butt welding.
.9 All welded stainless steel to be pickled and passivated as per ASTM A380 after welding.
.10 Copper pipe and tubing to be free from surface damage. Replace damaged pipe or tubing.
.11 Ream ends of pipe and tubes before being made up.
.12 Lay metal tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.
.13 Use non-corrosive lubricant or Teflon tape applied to male thread only.
.14 Groove pipe ends, cut square, seating surface clean and free from indent and score marks.
.15 Install dielectric fittings wherever piping of dissimilar metals are joined.
.16 Install flanges or unions to permit removal of equipment and valves without disturbing piping systems, as required by piping standard.
.17 Clean ends of pipes or tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.
.18 Support piping during construction to prevent abnormal stresses on the pipe works.
.19 Install pipe supports as required.
.20 Install pipe hangers as required.

.2 Flanges Bolting to Valves:

.1 Do not weld adjacent flanges when any valve is in place.
.2 Remove valve prior to welding.
.3 Clean gasket surfaces, flange faces and butt welding connections.
.4 Protect connecting surfaces.

.3 Bolted Connections:

.1 Clean pipe ends and gaskets.
.2 Lubricate gaskets with soapy water and bolts with thread lubricant.

.3 Tighten bolts progressively by crossover method and not in rotation around the joint.
.4 Tighten bolts to the torque recommended by the manufacturer.
.5 Use properly sized wrenches for bolt tightening to prevent rounding of nut and bolt heads.

.4 Threaded Connections:

.1 Clean pipe ends and threads.
.2 Use appropriate pipe dope for potable use when threading pipe.

3.4 WELDING SPECIFICATIONS

.1 Welders Qualifications:

.1 All welders shall have qualified under ASME B31.3-2018 Standard and have a Saskatchewan F3/F4 Pressure Welding Certificate. Welders shall be qualified by a local approved testing agency.

.2 Welding Procedures:

.1 Submit details of the procedures for the Contract Administrator review.
.2 All welding shall be carried out in accordance with ASME BPVC, Section IX, and ASME B31.1, B31.3, and B31.9 for Pressure Piping.
.3 The Contractor shall use adequate weather shields to protect the welding operation from rain, snow and wind. The Contract Administrator has the right to stop all welding if in his opinion adverse weather conditions will affect the quality of the weld.
.4 Where more than one pass is required, each pass, except the first and the final one, shall be peened to relieve shrinkage stresses. All dirt, slag and flux shall be removed before the succeeding bead is applied.

.3 Standard of Acceptability:

.1 The Engineer shall have the right to inspect all welds by visual, radiological or other non-destructive test method. Inspection may be made during welding or after the weld has been completed. Under visual examination welds shall be free of cracks, inadequate penetration, unrepaired burn-through and other defects, and shall present a neat workmanlike appearance. Radiological examination may be used at the discretion of the Contract Administrator to determine the penetration, slag inclusion, cracks and other defects. The Contract Administrator shall be the sole judge as to the acceptability of each weld.
.2 If a dispute results as to the acceptability of a weld, a specimen may be taken of the weld at the location determined by the Contract Administrator and subjected to tests in accordance with ASME B31.3-2018 Standards. An acceptable weld shall be per CSA Z662.
.3 If the specimen test shows that the weld is unacceptable as outlined above, the Contractor shall bear the full cost of all testing and repairing the pipe where the specimen is removed to the satisfaction of the Contract Administrator. The Contract Administrator shall have the right to reject any weld if in his opinion the weld defects are detrimental to the strength of the weld.

.4 The cost of all radiological inspection shall be born by the City unless the inspection was requested by the Contractor.

.4 Leakage Testing:

.1 Leakage testing on completed butt joints shall normally be made by testing the line hydrostatically to the pressure rating of the pipe.

.5 Repair of Defective Welds:

.1 Minor defects in welds may be removed by grinding out the defective portion. Replacement welds in joints may be checked by repeating the original test.
.2 Major defects and all cracks shall be cut out mechanically and the joint re-welded.
.3 All cost for repairing defective welds, including radiographic inspection of the corrected work, shall be borne by the Contractor.

3.5 VALVE INSTALLATION

.1 Storage of Valves:

.1 Store valves in cool and clean location, away from moving vehicles or other objects.
.2 Prevent dirt and debris entering the valve internals.
.3 Protect the valve seats against painting.
.4 Store valves with their handwheels, operator shafts and operators in an upright position.

.2 Handling Valves:

.1 Do not place chains, cables and ropes through valve ports or attached to operators or handwheels.
.2 Use sling either around valve body or with bolts or rods through the flange holes.

.3 Installation of Valves:

.1 Installation of valves to be by competent personnel and in strict accordance with manufacturer's instructions.
.2 Inspect pipe and remove all foreign debris or objects that may prevent closing of valve prior to the installation of any valves.
.3 Install butterfly valves with their operating shafts in the horizontal position unless otherwise directed by the Contract Administrator.
.4 Flanges or fittings adjacent to butterfly valves shall not be welded with the valve in place.

3.6 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.7 PIPE HANGERS AND SUPPORTS

.1 Hanger Spacing:

Spacing and middle attachment rod diameter as specified in paragraphs below or as table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of the Plumbing Code for the Province of Saskatchewan or authority having jurisdiction.
.2 Fire protection: to applicable fire code.
.3 Gas piping: up to 15 mm size - every 1.8 m.
.4 Copper piping: up to 15 mm size - every 1.5 m.
.5 PVC piping: To manufacturer's recommendation for the maximum temperature of the service and to prevent any visible deflection or movement.
.6 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
.7 Within 300 mm of each horizontal elbow.
.8 Table:

Maximum Pipe Size(mm)	Rod Diameter (mm)	Maximum Spacing Steel (m)	Maximum Spacing Copper (m)
To 30	10	2.1	1.8
40	10	2.7	2.4
50	10	3.0	2.7
65	10	3.6	3.0
75	10	3.6	3.0
100	16	4.2	3.6
150	22	5.1	
200	22	5.7	
250	22	6.6	
300	22	6.9	

.2 Hanger Installation:

.1 Offset Hanger so that rod is vertical in operating position.
.2 Adjust hangers to equalize load.

3.8 EQUIPMENT BASES AND SUPPORTS

.1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

3.9 LOW VELOCITY DUCT HANGERS AND SUPPORTS

.1 Hanger Minimum Sizes:

.1 Up to 750 mm wide: 25 x 1.6 mm at 3 m spacing.
.2 790 to 1200 mm wide: 40 x 1.6 mm at 3 m spacing.
.3 Over 1200 mm wide: 40 x 1.6 mm at 2.4 m spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

.1 Up to 450 mm wide: 40 x 1.6 mm or 25 x 25 x 3 mm at 2.4 m spacing.
.2 480 x 1000 mm wide: 40 x 40 x 3 mm at 1.2 m spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes at 3.65 m spacing:

.1 Up to 610 mm wide: 40 x 1.6 mm.
.2 640 to 900 mm wide: 25 x 25 x 3 mm.
.3 Over 1520 mm wide: 50 x 3 mm.
.4 940 to 1200 mm wide: 30 x 30 x 3 mm.

.4 Vertical Duct Floor Supports Minimum Sizes, riveted or screwed to ducts:

.1 Up to 1520 mm wide: 40 x 40 x 3 mm.
.2 Over 1520 mm wide: 50 x 3 mm.

3.10 FLASHING

.1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

.2 Flash vent and soil pipes projecting 75 mm minimum above roof membrane with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead minimum 250 mm clear on sides. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations, minimum 200 mm high.

.5 Attach counterflashings to mechanical equipment and lap base flashings on roof curbs.

.6 All joints in counterflashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Use storm collars above all roof jacks.

.7 Screw vertical flange section of roof jacks to face of curb.

.8 Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.11 PROTECTION OF OPENINGS

.1 Protect equipment and system openings from dirt, dust and other foreign materials.

.2 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign substances prior to being put into operation.

3.12 EQUIPMENT PIPING CONNECTIONS

.1 Where equipment connections are a different size from the piping serving it all associated isolating valves and fittings to be the larger pipe size unless specifically indicated otherwise on the drawings. This rule to also apply in the case of control valves.

3.13 SLEEVES

.1 Provide individual metal sleeves for all pipes, tubes or ducts penetrating all walls and floor slabs. Grout tightly in place for full depth of wall or slab.

.2 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.3 Standard sleeves to be 22 Ga. galvanized sheet steel with lock seam joints.

.4 Use cast iron or steel pipe sleeve with annular fin continuously welded at midpoint:

.1 Through foundation walls.
.2 Where sleeve extends above finished floor.

.5 Sizes:

.1 Refer to mechanical drawings for details.
.2 Provide 6 mm clearance all around, between sleeves and pipe or between sleeve and insulation.

.6 Terminate sleeves flush with surface of concrete and masonry and above floors.

.7 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water-tight, durable joint.

.8 Voids Around Pipes:

.1 Where sleeves pass through walls or floors, caulk space between sleeve and insulation or between sleeve and pipe with dry oakum. Seal space at each end of sleeve with waterproof, fire retardant, non-hardening mastic.
.2 Ensure no contact between copper tube or pipe and ferrous sleeve.
.3 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

.9 Where pipes and ducts pass through walls and floors having a fire separation rating, pack the space with approved caulking material and seal in accordance with CGSB19-GP-9.

3.14 ESCUTCHEONS AND PLATES

.1 Install on pipes passing through finished walls, floors, and ceilings.

.2 Use chrome or nickel plated brass, solid type with set screws for ceiling or wall mount.

.3 Inside diameter to fit around finished pipe. Outside diameter to cover opening or sleeve.

.4 Where sleeve extends above finished floor, escutcheons or plates to clear sleeve extension.

.5 Secure to pipe or finished surface but not to insulation.

3.15 CUTTING AND PATCHING

.1 Minimize cutting and patching required. Set sleeves and mark openings in concrete forms and masonry structure prior to the placement of concrete or masonry.

END OF SECTION

1. GENERAL

1.1 REFERENCES

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 specified equipment and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.3 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for specified equipment for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, the 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.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to the Contract Administrator for approval. Submission of individual data will not be accepted unless directed by the Contract Administrator.

.2 Make changes as required and re-submit as directed by the Contract Administrator.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 The Contract Administrator will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to the Contract Administrator for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect all specified equipment and materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2. PRODUCTS

2.1 NOT USED

.1 Not used.

3. EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for mechanical equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Contract Administrator.

.2 Inform the 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 the Contract Administrator.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

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

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

.1 The 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.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 The Contract Administrator will record these demonstrations on video tape for future reference.

3.6 CLEANING

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

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

3.7 PROTECTION

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

END OF SECTION

1. GENERAL

1.1 REFERENCE DOCUMENTS

.1 Pipe supports shall meet the requirements of ANSI/ASME B31.1-1995, Power piping.

.2 Duct hangers shall follow the recommendations of the SMACNA Duct Manuals.

1.2 GENERAL REQUIREMENTS

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction and to accommodate insulation; provide insulation protection saddles.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building steel or inserts in concrete construction.

.5 Provide and set sleeves required for equipment, including openings required for placing equipment.

.6 Dielectrically isolate dissimilar metals.

.7 Pipe, duct and conduit supports are not all necessarily shown on the Contract Drawings. The Contractor is responsible to ensure sufficient supports are supplied, fabricated, and installed to properly secure all pipe, fittings, and equipment to satisfy manufacturer’s recommendations.

1.3 APPROVALS

.1 Obtain approval from the Engineer prior to drilling for inserts and supports for piping systems.

.2 Obtain approval from the Engineer prior to using percussion type fastenings.

.3 Use of perforated band iron, wire or chain as hangers is not permitted.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.5 QUALITY ASSURANCE

.8 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section

.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.

.9 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2. PRODUCTS

2.1 INSERTS

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers: Pipe sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes 150 mm Over: Adjustable wrought steel clevis.

.3 Hangers: Hot Pipe Sizes 150 mm: Adjustable steel yoke and cast-iron roll.

.4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.

.5 Wall Support: Pipe Sizes to 80 mm: Cast iron hook.

.6 Wall Support: Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast-iron roll for hot pipe sizes 150 mm and over.

.7 Vertical Support: Steel riser clamp.

.8 Floor Support: Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.9 Floor Support: Hot Pipe Sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

.10 Design hangers so they cannot become disengaged by movements of supported pipe.

.11 Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

.12 Insulate all piping from dissimilar metal supports.

2.3 HANGER RODS

.1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

2.4 DUCT HANGERS AND SUPPORTS

.1 Hangers: Galvanized steel band iron or rolled angle and 10 mm rods.

.2 Wall Supports: Galvanized steel band iron or fabricated angle bracket.

.3 Vertical Support at Floor: Rolled angle.

2.5 FLASHING

.1 Steel Flashing: 0.55 mm galvanized steel.

.2 Lead Flashing: sheet lead, as follows:

.1 For Waterproofing: 25 kg/m^2.

.2 For Soundproofing: 5 kg/m^2.

.3 Lead Sheet Size:

.1 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.

.2 Floor Drains: minimum 920 x 920 mm and as specified.

.3 Other Locations: as specified.

.3 Safes: 25 kg/m^2 sheet lead or 200 micrometre neoprene.

.4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.6 SLEEVES

.1 Pipes through Floors: Form with 1.2 mm galvanized steel.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe or 1.2 mm thickness galvanized steel.

.3 Round Ducts: Form sleeves with galvanized steel.

.4 Rectangular Ducts: Form sleeves with galvanized steel or wood.

.5 Size large enough to allow for expansion with continuous insulation.

2.7 FINISHES ON HANGER RODS, HANGERS, AND SUPPORTS

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

3. EXECUTION

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size	Distance Between Supports	Hanger Rod Diameter
15 mm	1.8 m	10 mm
20 mm to 40 mm	1.8 m	10 mm
50 mm & 65 mm	3.0 m	10 mm
80 mm & 100 mm	3.6 m	16 mm
150 mm to 300 mm	4.3 m	22 mm
350 mm to 450 mm	6.1 m	25 mm

.2 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

.9 Each pipe run is to be supported by at least two transverse braces and one longitudinal brace.

3.3 LOW VELOCITY DUCT HANGERS AND SUPPORTS

.1 Hanger Minimum Sizes:

.1 Up to 750 mm wide: 25 x 1.6 mm at 3 m spacing.

.2 790 to 1200 mm wide: 40 x 1.6 mm at 3 m spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

.1 Up to 450 mm wide: 40 x 1.6 mm or 25 x 25 x 3 mm at 2.4 m spacing.

.2 480 x 1000 mm wide: 40 x 40 x 3 mm at 1.2 m spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes at 3.65 m spacing:

.1 Up to 610 mm wide: 40 x 1.6 mm.

.2 640 to 900 mm wide: 25 x 25 x 3 mm.

.4 940 to 1200 mm wide: 30 x 30 x 3 mm.

.4 Vertical Duct Floor Supports Minimum Sizes, riveted or screwed to ducts:

.1 Up to 1520 mm wide: 40 x 40 x 3 mm.

.5 Each section of ductwork is to be supported by at least two transverse braces. The first transverse brace is to be installed on the first duct support and additional braces are to be installed at 9.1m (30ft) intervals.

.6 Each section of ductwork is to be supported by at least one longitudinal brace and additional longitudinal braces are to be installed at 18.2 (60ft) intervals.

3.4 EQUIPMENT BASES AND SUPPORTS

.1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

3.5 FLASHING

.1 Flash and counter flash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

.2 Flash vent and soil pipes projecting 75 mm minimum above roof membrane with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead minimum 250 mm clear on sides. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations, minimum 200 mm high.

.5 Attach counter flashings to mechanical equipment and lap base flashings on roof curbs.

.6 All joints in counter flashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Use storm collars above all roof jacks.

.7 Screw vertical flange section of roof jacks to face of curb.

.8 Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.6 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping or ductwork passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Install chrome plated escutcheons where piping passes through finished surfaces.

3.7 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

3.8 CLEANING

.3 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

3.9 PROTECTION

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

.6 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 The hydrostatic and pressure testing procedures outlined in this section are applicable to all non-buried piping systems.

.2 All water retaining or carrying pipes and structures, and all chemical solution components shall be tested for leakage.

.3 Where work is undertaken within existing structures or piping, they shall be pressure tested and disinfected prior to being put back into operation.

.4 All testing shall be as specified herein or elsewhere in these specifications or as directed by the Contract Administrator.

.5 The Contractor shall furnish the suitable temporary service connections, testing plugs or caps, pressure pumps, pipe connections, gauges, thrust supports, and all other required equipment and labour necessary for filling the pipeline or structure, expelling air, pumping to the required test pressure, and dewatering the line or structure without additional compensation.

1.3 REFERENCE STANDARDS

.1 All materials, equipment, substances, etc. that will come in contact with potable water shall conform to ANSI/NSF standards 60/61 and the manufacturers shall be included on the list of approved manufacturers published by ANSI/NSF.

.2 Hydrostatic testing procedures for PVC pipe systems, as outlined in *AWWA Manual M23 – PVC Pipe –Design and Installation,* latest edition.

.3 Hydrostatic testing procedures for steel pipe systems, as outlined in *AWWA Manual M11 – Steel Pipe – A Guide for Design and Installation*, latest edition.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, closeout submittals to include hydrostatic and pressure testing results and section of piping that was tested.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section

.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.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2. PRODUCTS

2.1 WATER

.1 All water used for the hydrostatic and pressure testing will be supplied by the City from the distribution system at no cost to the Contractor. All water required for retesting, following the failure of the initial test, will be supplied by the City at the Contractor's expense. The water rate will be based on current residential rates.

.2 The Contractor shall be responsible for the supply and installation of all temporary pipework, pumps, water trucks or other equipment required to transport the water from the point of supply to the structure or piping to be tested.

.3 The Contractor shall provide the City and the Contract Administrator with 48 hours of notice of his requirement for water for testing.

3. EXECUTION

3.1 CLEANING

.1 Prior to hydrostatic or pressure testing, all water retaining structures, pipework and conduits shall be thoroughly cleaned. All dirt and loose material shall be removed.

3.2 HYDROSTATIC TESTING OF FIBERGLASS AND OTHER PREFABRICATED RESERVOIRS

.1 An initial hydrostatic test shall be undertaken by the supplier prior to shipping and a certificate supplied to the City. A second hydrostatic test shall be completed after installation. Test duration shall be for 24 hours.

.2 The Contract Administrator shall be notified at least 48 hours before any testing begins, and the procedures and leak detection method shall be submitted in writing to the Contract Administrator for his review. Perform test in the presence of the Contract Administrator.

.1 If any test shows leakage, or if leaks or persistently damp patches are visible, the structure shall be emptied, carefully examined, and all defects repaired by the method outlined elsewhere in these specifications or by other means approved by the Contract Administrator. Such tests shall be repeated until no leak or persistently damp patches are present.

3.3 HYDROSTATIC TESTING OF WATER RETAINING CONCRETE STRUCTURES

.1 Hydrostatic testing shall be carried out only after the structures have been completely constructed and structural concrete has achieved (28-day) design strength.

.2 Backfilling or damp proofing shall not be started until testing has shown the structures to be watertight.

.3 Prior to commencing the hydrostatic testing of structures, the Contractor shall repair all visible cracks in the walls, roof, and floor.

.4 The Contract Administrator shall be notified at least 72 hours before any testing begins, and the procedures and leak detection method shall be submitted in writing to the Contract Administrator for his review. Perform test in the presence of Contract Administrator.

.5 The Contractor shall ensure that the exterior surface of the water retaining structures which are being hydrostatically tested are maintained at a minimum temperature of 5 degrees Celsius during the entire testing period. The cost of heating and hoarding (if required) to achieve this minimum testing temperature shall be borne by the Contractor.

.6 Fill the water retaining structure to overflow level (which will be designated by a mark scored on the tank wall) at a rate of not more than 600mm (2 ft) per day. The test shall begin once the level is at overflow level and continue for 48 hours. There shall be no persistent damp areas on exterior walls or visible leakage at any point on the structure and no lowering of the water level during the test period. The Contract Administrator shall provide the sole determination for evaporation allowance.

.7 If any test shows leakage or if leaks or persistently damp patches are visible, the structure is to be emptied, carefully examined, and all defects repaired by the method outlined elsewhere in these specifications, or by other means approved by the Contract Administrator. Such tests to be repeated until no leak or persistently damp patches are present.

.8 Upon mutual agreement between the Contractor and the Engineer, the reservoir may be backfilled completely before the leakage test is undertaken. The leakage test is to then be performed by filling the structure to overflow elevation and monitoring water level for a period of not less than 48 hours. During this period, there shall be no lowering of the

water level. If water level is found to drop during the test period, the Contractor is responsible for all costs incurred to bring the leakage within the allowable limits, including any excavation and backfilling required to facilitate repairs, if necessary.

3.4 PRESSURE TESTING OF PIPING

.1 Pressure testing shall be conducted on the piping to the pressures and durations as follows (or the maximum rated pressure of the pipeline, whichever is less):

.1 Steel pipe systems:
- .1 Test Pressure: 125% of design operating pressure
- .2 Test Duration: 2 Hours

.2 PVC pipe systems:
- .1 Test Pressure: 150% of design operating pressure
- .2 Test Duration: 1 Hour

.2 Where any section of piping is provided with concrete thrust blocks, do not conduct tests until at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.3 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied, if necessary.

.4 Thoroughly examine exposed parts while under pressure and correct for leakage as necessary. Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.5 The amount of leakage during the test period shall be zero. Repeat hydrostatic test until all defects have been corrected and no loss of water is observed**.**

3.5 INSTRUMENTATION PROTECTION

.1 All instruments that have a maximum range of less than the hydrostatic or pneumatic test pressure noted above shall be removed or isolated during the pressure tests. On successful completion of the system test, the pressure shall be lowered to a pressure within the range of the instruments, and the isolated or removed instruments shall then be tested in accordance with other sections of these specifications.

3.6 SAFETY RELIEF VALVES

.1 All safety relief valves for water services shall be supplied with test gauges for hydrostatic testing purposes. Upon completion of the hydrostatic testing, the Contractor shall remove the test gauges and repressure the system to the relieving pressure of the relief valves to ensure that the valves are relieving at their setpoint.

3.7 DEFECTS AND REPAIRS

.1 Defects disclosed in the work shall be made good and retested or the work replaced without additional cost to the City.

.2 Repairs to the piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Where it becomes necessary to replace pieces of pipe, such replacements shall be the same lengths as the defective pieces. Where the repairs are required to PVC pipe, the pipe shall be replaced as far as the first detachable fitting in each direction from the defect. Under no circumstances shall a new section of pipe be installed with solvent welded couplings.

.3 Tests shall be repeated after any work has been replaced if, in the judgement of the Contract Administrator, it is necessary.

.4 All pressure testing shall be done in the presence of the Engineer or Contract Administrator.

3.8 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O&M Personnel, supplemented as specified.

3.9 CLEANING

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

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

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

.1 Remove recycling containers and bins from site and dispose of materials to an appropriate facility.

3.10 PROTECTION

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

.2 Repair damage to adjacent materials caused by hydrostatic and pressure testing.

END OF SECTION

1. GENERAL

1.1 REFERENCES

.1 ASTM International

.1 ASTM A126-[04(2009)], Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-[09], Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.1 ANSI/AWWA C700-[09], Standard for Cold Water Meters-Displacement Type, Bronze Main Case.

.2 ANSI/AWWA C701-[12], Standard for Cold Water Meters-Turbine Type for Customer Service.

.3 ANSI/AWWA C702-[10], Standard for Cold Water Meters-Compound Type.

.3 CSA International

.1 CSA-B64 Series-[11], Backflow Preventers and Vacuum Breakers.

.2 CSA B79-[08], Commercial and Residential Drains and Cleanouts.

.3 CAN/CSA-B356-[10], Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP).

.1 IPMVP [2007] Version.

.5 Plumbing and Drainage Institute (PDI)

.1 PDI-G101-[R2010], Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.

.2 PDI-WH201-[R2010], Water Hammer Arresters Standard.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with contractor's representative and the Contract Administrator to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.2 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details, and accessories.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Bid Opportunity 479-2024 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2. PRODUCTS

2.1 MATERIALS – GENERAL

.1 All materials to be new, free from defects and conforming to applicable reference standards.

.2 All materials, linings and coatings in contact with water to be NSF approved for potable water.

.3 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

2.2 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Interior Cold Only Hose Bibb**:** 20mm diameter of bronze construction with integral vacuum breaker to CAN/CSA B64, hose thread spout, composition disk, and chrome plated in finished areas. Provide heavy duty aluminum hose rack at each hose bib location.

2.5 SHUTOFF VALVES

.1 20mm diameter, bronze 2-piece body, chrome-plated brass ball, PTFE seats, solder joint, 4100 kPa CWP, handle operator, Crane 9300 Series.

2.6 BACKFLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, reduced pressure principle type.
.2 As indicated on Drawing – Equipment Schedule.
.3 Acceptable Manufacturers: Watts

2.7 WATER METERS

.1 Turbine type to AWWA C701 and as per City of Winnipeg requirements.
.2 As indicated on Drawing – Equipment Schedule.
.3 Acceptable Manufacturers: Neptune

2.8 STRAINER

.1 Cast bronze “Y” type strainer.
.2 Certified to NSF/ANSI 372.
.3 Screen 20 Mesh stainless Steel.
.4 As indicated on Drawing – Equipment Schedule.
.5 Acceptable Manufacturers: Zurn.

2.9 PRESSURE REDUCING VALVE

.1 Adjustable from one hundred seventy-two (172) to five hundred seventeen (517) kPa (twenty-five (25) to seventy-five (75) pounds per square inch).
.2 As indicated on Drawing – Equipment Schedule.

.3 Acceptable Manufacturers: Watts.

2.10 SIGHT GLASS

.1 Clear Schedule 40 PVC pipe, no scale.

2.11 SOLENOID VALVE

.1 Where mechanical seals require external seal water, supply one (1) solenoid valve per pump for the purpose of controlling seal water flow.
.2 Seal water solenoid valves are not required to be provided if the pumps utilize an internal sealed oil reservoir.
.3 Solenoid valves to operate off 120VAC, 60Hz supply.
.4 Provide one (1) flow switch with 24 VDC for each pump flush water system.

3. EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialities and accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Contract Administrator.
.2 Inform the 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 the Contract Administrator.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 PREPARATION

.1 Valve and piping arrangement indicated in the drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in piping to allow for discrepancies between valve dimensions shown and those supplied for the work.

.2 Field measure and check all equipment locations, pipe alignments, and structural installation prior to installation of valves. Ensure that valve locations and orientations provide suitable access to manual operators and that sufficient space and accessibility is available for pneumatic and electric actuators.

.3 Where conflicts are identified, inform the Contract Administrator and initiate the necessary piping modifications at no cost to the City.

3.4 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada, provincial codes, local authority having jurisdiction.

.1 Install all equipment in strict accordance with manufacturer's and supplier's instructions.

.2 Any damage resulting from either failure to observe the installation instructions or as a result of proceeding with the work without complete knowledge of how it is to be done will be the Contractor's responsibility.

.3 Make equipment installation and connections by skilled tradesmen to the best standard.

.4 Carry out work to produce a neat, accurate, secure, functional installation.

.5 Repair at own expense, any damage done to the installation of materials while carrying out the work.

.6 Install supports and bases in advance of equipment installation in accordance with manufacturer's instructions.

.7 Generally pipe supports and hangers are not shown unless for indication purposes only.

3.5 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.6 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 for maintenance.

3.8 PRESSURE IDICATORS

.1 Isolation Valves

.1 Isolate all indicators from service to allow for removal and maintenance.

.2 Use 316 stainless steel ball valves on stainless steel and carbon steel piping, bronze body valves on copper piping, and PVC ball valves on PVC piping.

.3 Isolation valves diameter are to match equipment process connections.

3.9 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water supply systems operational.

.3 Provide continuous supervision during start-up.

3.10 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.4 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.5 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.6 Access doors:

.1 Verify size and location relative to items to be accessed.

.7 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.8 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.9 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

.10 Hose bibbs, sediment faucets:

.1 Verify that flow and pressure meet design criteria.

.2 Check for leaks, replace compression washer if required.

3.11 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

3.12 CLEANING

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

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

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

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

3.13 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

1. GENERAL

1.1 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.4 Instructions: submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: manufacturers' field reports specified.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

2. PRODUCTS

2.1 SUMP PUMP SUBMERSIBLE – P- F05

.1 General Construction:

.1 Class 25 cast iron housing with powder coat finish.

.2 Discharge Size: 50.8 mm (2”) NPT.

.3 Maximum solid handling capability: 19 mm (3/4”).

.4 Stainless steel shaft and hardware.

.5 Seals: Unitized carbon/ceramic seal with stainless steel housing and spring.

.6 Impeller: vortex style, polymer material.

.2 Motor: Oil filled permanent split capacitor, rated for continuous duty.

.1 3/4 hp.

.2 120 V/1 Ph/60 Hz.

.3 Class B insulated NEMA B design.

.4 Internal thermal overloaded protection.

.3 Control:

.1 The pump shall be controlled with a float-switch style on/off switch.

.4 Acceptable product: Liberty Pumps, series-290 or approved equal in accordance with B8.

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 Ensure pump and motor assembly do not support piping.

.2 Install as per manufacturers recommendations and guidelines

3.3 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Start pumps, check impeller rotation.

.3 Check for safe and proper operation.

.4 Eliminate causes of cavitation, flashing, air entrainment.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 22 05 15 – Plumbing Specialities and Accessories.

.2 Section 23 05 00 – Common Work Results – Mechanical

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15-13, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18-12, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22-13, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.

.6 ASME B31.9-14, Building Services Piping.

.2 ASTM International (ASTM)

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

.2 ASTM A 351/A 351M, Castings, Austenitic, for Pressure Containing Parts.

.3 ASTM B 32, Standard Specification for Solder Metal.

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 ANSI/AWWA C151/A21.51, Ductile Iron Pipe, Centrifugally Cast, for Water.

.3 AWWA C904-[06], Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service.

.4 CSA Group (CSA)

.1 CSA B137.5, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.2 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

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

.1 Safety Data Sheets (SDS).

.6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.7 National Research Council (NRC)

.1 National Plumbing Code of Canada (NPC).

.8 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

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 insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00- Closeout Submittals.

.1 Administrative, temporary and procedural requirements for the use of materials and methods of construction.

2. PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground:

.1 PEX Piping to CSA B137.5

.2 Type L Copper Tubing to ASTM B88

.3 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 to ASTM D2467

.4 Polypropylene (PP) Pipe to CSA B137.11:23

2.2 FITTINGS

.1 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15

.2 NPS 2 and larger:

.1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242

.2 PEX fittings to CSA B137.5 and F1960

.3 NPS 1 ½ and smaller:

.1 PEX fittings to CSA B137.5

.2 Type L Copper Tubing to ASTM B88

.4 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

.1 ASTM D2467

.5 Polypropylene (PP) Pipe to

.1 CSA B137.11:23

2.3 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to AWWA C111

.2 Bolts, nuts, hex head and washers: to ASTM A 307, heavy series

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

.7 NPS 1 ½ and smaller: PEX fittings to CSA B137.5

.8 NPS 2 and larger: PEX fittings to CSA B137.5 and ASTM F 1960. Elbows, adapters, couplings, plugs, tees, multi-port tees and valves.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.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.

2.5 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless ball, PTFE adjustable packing, brass gland and Buna-N seat, stainless steel lever handle.

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 Manitoba Plumbing Code and local authority having jurisdiction.

.1 Provide pipe supports at a maximum horizontal spacing to meet Manitoba Plumbing Code requirements.

.1 Copper Pipe: 3m

.2 PVC Pipe: 1.2m

.3 PEX: 0.8m

.2 Pipe supports shall be located at high elevation or close to the mounting service to avoid interference with other building systems.

.3 Routing shown on drawing is schematic in nature. Contractor shall field route small bore piping systems to avoid interferences, as required.

.4 Provide pipe support standoff from mounting surface, so pipe is not in direct contact. Fasteners shall be suitable for the substrate (ie: concrete, wood, metal, etc).

.5 Provide riser clamp pipe supports for all vertical piping risers.

.6 Completely seal pipe penetrations and provide an escutcheon cover at the main floor level between the dry well and the electrical room.

.7 Paint all metallic pipe supports to protect from corrosion.

.2 Install pipe work as shown on drawing 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.

.7 Valves

.1 Isolate equipment, fixtures and branches with ball valves as indicated 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 – Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is

clean to Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to Provincial potable water guidelines.

.2 Upon completion, provide laboratory test reports on water quality for Contract Administrator approval.

3.7 START-UP

.1 Complete start-up and commissioning in accordance with section 01 91 13 – General Commissioning Requirements.

.2 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

.4 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 Verify that all new piping accessories, valves and equipment are in good working condition.

.4 Check control, limit, safety devices for normal and safe operation.

.5 Confirm compliance with safety and health requirements.

.6 Check that water quality is consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.5 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Timing:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 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, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 22 05 15 – Plumbing Specialities and Accessories.

.2 Section 23 05 00 – Common Work Results – Mechanical

.3 Section 23 05 15 - Common installation requirements for HVAC pipework

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D 2564, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 CSA Group (CSA)

.1 CAN/CSA-Series B1800, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.

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

.1 Safety Data Sheets (SDS).

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada (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 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.

2. PRODUCTS

2.1 MATERIAL

2.2 PIPING AND FITTINGS

.1 For above ground DWV to:

.1 CAN/CSA B1800.

.2 For above ground wastewater piping associated to level gauge piping system within sub-level 3.

.1 PVC SCH 80

.2 Refer to mechanical drawing for details.

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D 2564

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 Manitoba Plumbing Code and local authority having jurisdiction.

.1 Provide pipe supports at a maximum horizontal spacing to meet Manitoba Plumbing Code requirements.

.1 Copper Pipe: 3m

.2 PVC Pipe: 1.2m

.3 PEX: 0.8m

.2 Pipe supports shall be located at high elevation or close to the mounting service to avoid interference with other building systems.

.3 Routing shown on drawing is schematic in nature. Contractor shall field route small bore piping systems to avoid interferences, as required.

.4 Provide pipe support standoff from mounting surface, so pipe is not in direct contact. Fasteners shall be suitable for the substrate (ie: concrete, wood, metal, etc).

.5 Provide riser clamp pipe supports for all vertical piping risers.

.6 Completely seal pipe penetrations and provide an escutcheon cover at the main floor level between the dry well and the electrical room.

.7 Paint all metallic pipe supports to protect from corrosion.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 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).

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.3 Electrical Equipment Manufacturers' Association Council (EEMAC)

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

.1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Provinces of Manitoba.

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 The Contract Administrator will make available 1 copy of systems supplier's installation instructions.

.4 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial /Territorial regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Bid Opportunity 479-2024.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

2. PRODUCTS

2.1 GENERAL

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by the Contract Administrator for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm thick sheet metal tops and bottoms.

.3 38 mm dia holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.5 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

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 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

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

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00- Submittal Procedures.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06- Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

2. PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from 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.

3. EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 23- Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On both sides of visual obstruction or where run is difficult to follow.

.2 At least once in each small room through which piping or ductwork passes.

.3 On both sides of separations such as walls, floors, partitions.

.4 At beginning and end points of each run and at each piece of equipment in run.

.5 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.6 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 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 a frame behind non-glare glass where directed by the Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

3.7 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods, and requirements of testing, adjusting, and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to the 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.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started confirm in writing to the 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 the 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.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by the Contract Administrator for verification of TAB reports.

1.9 START OF TAB

.1 Notify the Contract Administrator 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weather-stripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed; volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 5 %, minus 5 %.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to the Contract Administrator list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to the Contract Administrator.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of the 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.

1.15 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 6 copies of TAB Report to the Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by the 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 the Contract Administrator.

.4 Pay costs to repeat TAB as required to satisfaction of the Contract Administrator.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of the 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.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by the Contract Administrator.

1.19 AIR SYSTEMS

.1 Do TAB of systems, equipment, components, controls specified Division 23.

.2 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.

.3 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.4 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times meet design conditions.

1.21 POST-OCCUPANCY TAB

.1 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

2. PRODUCTS

2.1 NOT USED

.1 Not used.

3. EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 22 00 15 – Mechanical General Requirements

1.2 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 1 for requirements pertaining to product options and substitutions.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Comply with requirements of Section 22 00 15.

.2 Submit an insulation schedule, including the following information for each application:

.1 Material
.2 "k" value
.3 Thickness
.4 Density
.5 Finish
.6 Jacket

.3 Submit product data and test reports when requested to substantiate that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements for the assembly and thickness used.

1.4 DEFINITIONS

.1 For the purposes of this section, the following definitions apply:

.1 Concealed: ductwork and equipment in shafts, furring, suspended ceilings and attics.
.2 Exposed: ductwork and equipment in mechanical rooms or otherwise not "concealed".
.3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

1.5 FLAME/SMOKE DEVELOPMENT RATINGS

.1 Duct insulation, recovery materials, vapour barrier facings, tapes and adhesives shall have maximum flame spread ratings less than or equal to 25 and maximum smoke developed less than or equal to 50, when tested in accordance with CAN/ULC S102-1988, NFPA 255-1996 or ASTM E84-96a.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411-82.

2. PRODUCTS

2.1 HOT DUCT INSULATION

.1 Hot Duct Insulation - Round and Oval:

.1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
.2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature
.3 Service Temperature: 20°C to 65°C
.4 Specified material:
.1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

.2 Hot Duct Insulation – Rectangular:

.1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
.2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature
.3 Service Temperature: 20°C to 65°C
.4 Specified material:
.1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

2.2 COLD DUCT INSULATION

.1 Cold Duct Insulation - Round and Oval:

.1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
.2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature
.3 Service Temperature: -40°C to 65°C
.4 Specified material:
.1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

.2 Cold Duct Insulation - Round (Exposed to Outdoors):

.1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
.2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature
.3 Service Temperature: -40°C to 65°C
.4 Specified material:
.1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

.3 Cold Duct Insulation - Rectangular:

.1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
.2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature
.3 Service Temperature: 20°C to 65°C

.4 Specified material:
.1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

2.3 ACOUSTIC DUCTWORK INSULATION

.1 Material: flexible duct liner insulation made from strong, glass fibers bonded with a thermosetting resin

.2 Acoustic Properties: minimum NRC or 0.75 for 25 mm thickness

.3 "k" Value: maximum 0.035 W/m°C at 24°C mean temperature

.4 Service Temperature: -40°C to 65°C

.5 Surface Finish: air stream side coated to prevent fibre erosion. Surface roughness not exceeding 0.58 mm

.6 Specified material:
.1 Manufacturer: John Manville/ Linacoustic RC Fiber Glass Duct Liner with Reinforced Coating System

2.4 ACCESSORIES

.1 FSK Tape: vapour barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self adhesive.

.2 ASJ Tape: vapour resistant tape consisting of all service jacket material with pressure sensitive self adhesive.

.3 Contact Adhesive: quick setting, adhesive to adhere flexible or rigid mineral fibre insulation to ducts.

.4 Lap Seal Adhesive: quick setting adhesive for joints and lap sealing of vapour barriers.

.5 Pins: welding pins 4 mm diameter shaft with 35 mm diameter head for installation through the insulation. Length to suit thickness of insulation with 32 mm square nylon retaining clips.

.6 Finishing Cement: to CAN/CGSB-51.12-95, Type 1 - mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.

2.5 RECOVERY MATERIALS

.1 Aluminum Jacket reinforced with fiber glass scrim laminated to UL rated kraft, secured with mechanical fastener.

.2 Canvas finish to match existing finishes.

3. EXECUTION

3.1 INSTALLATION, GENERAL

.1 Dimensions shown are clear inside free area measurement regardless of insulation placement. Fabricate ducts accordingly.

.2 Apply insulation after required duct system tests have been completed and inspected by the City.

.3 Ensure duct surfaces are clean and dry before installing insulation.

.4 Install insulation over entire surface of duct, for full length of duct run including portions of duct passing penetrations through walls and floors.

.5 Install insulation in a manner to ensure hangers and standing duct seams do not penetrate insulation.

.6 Locate finished seams in least visible location.

.7 Insulate and clad exterior ductwork as cold duct and 50mm of insulation. Where ducts are insulated with acoustic insulation, the exterior insulation can be reduced to maintain a total 50mm insulation R-value.

.8 Install insulation at ambient temperatures within acceptable ratings for tapes, sealants and adhesives.

3.2 COLD DUCT INSULATION APPLICATION

.1 Adhere mineral fibre insulation to round and oval ductwork with adhesive applied in 150 mm wide strips on 400 mm centres. Band on outside until mastic sets then remove bands.

.2 Butt mineral fibre insulation and seal joints with lap seal adhesive; cover joint with FSK tape.

.3 Secure rigid insulation on rectangular ducts with 50% area coverage of adhesive and impale on pins located 400 mm on centre and secure in place with the retaining clips.

.4 Butt rigid insulation on rectangular ducts and seal joints with lap seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two coats of lap seal adhesive.

3.3 ACOUSTIC DUCT INSULATION APPLICATION

.1 Line ducts with flexible or rigid acoustic insulation. Line plenums with rigid acoustical insulation. Adhere insulation to duct with 100% coverage of contact adhesive and pins located 400 mm OC each way. Secure in place with retaining clips. Remove excess length of pins and cover with brush coat of lap seal adhesive.

.2 Bevel corners at joints and butt together. Brush coat all cut edges with lap seal adhesive. Install acoustic gauze over all cut corners and joints and brush coat with lap seal adhesive.

.3 Where duct velocities exceed 20 m/s, cover insulation with 0.8 mm perforated galvanized steel with 24% free area.

3.4 EXPOSED DUCTS

.1 Finish ducts exposed to outdoors with aluminum jacket. Caulk all joints on jacket for weathertight finish.

.2 Interior ducts exposed in mechanical spaces to be finished with canvas. Painted with any required identification.

3.5 INSULATION TYPE AND THICKNESS SCHEDULE

Service Type	Insulation Type	Insulation Thickness (mm)
Exhaust and relief ducts within 3 m of exterior openings	Hot duct	25
Exhaust air in attics	Hot duct	25
Relief ducts and plenums	Hot duct	25
Supply ducts and plenums	Hot duct	25
Blower ducting (aluminum recovery to be used)	Hot/cold duct	25
Outside air	Cold duct	50
Mixing plenums	Cold duct	50
Supply air plenums	Cold duct	25
Medium pressure supply ducts	Cold duct	25
Low pressure supply ducts	Cold duct	25
Supply and return ducts in attics or exposed to outdoors	Cold duct	50
Ventilation equipment	Cold duct	50

END OF SECTION

1. GENERAL

1.1 REFERENCES

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

.1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 16 - Cleaning and Start-up of Mechanical Piping Systems.

1.3 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures, and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.

.2 Boiler and/or chiller operation.

.3 Pressure bypass open/closed.

.4 Control pressure failure.

.5 Maximum heating demand.

.6 Maximum cooling demand.

.7 Boiler and/or chiller failure.

.8 Cooling tower (and/or industrial fluid cooler) fan failure.

.9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.4 POTABLE WATER SYSTEMS

.1 When cleaning is completed, and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in Division 23.

.2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.

.3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

1.5 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Buried systems: perform tests prior to backfilling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank, and operate each fixture to verify drainage and no leakage.

.5 Cleanouts: refer to Section 22 05 15 - Plumbing Specialties and Accessories.

.6 Roof drains:

.1 Refer to Section 22 05 15 - Plumbing Specialties and Accessories.

.2 Remove caps as required.

1.6 REPORTS

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.

1.7 TRAINING

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified herein.

2. PRODUCTS

2.1 NOT USED

.1 Not Used.

3. EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1. GENERAL

1.1 ALTERNATIVES

.1 Size round ducts installed in place of rectangular ducts indicated from ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration of sizes permitted except by written permission.

1.2 DEFINITIONS

.1 Low Pressure: Static pressure in duct less than 0.5 kPa and velocities less than 10 m/s.

.2 Medium Pressure: Static pressure in duct less than 1.5 kPa and velocities greater than 10 m/s.

.3 High Pressure: Static pressure over 1.5 kPa and less than 2.5 kPa and velocities greater than 10 m/s.

.4 Duct Sizes: Inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

1.3 SUBMITTALS

.1 Submit shop drawings and samples of duct fittings for approval, including particulars such as thicknesses, welds and configurations prior to start of work.

.2 Submit shop drawings for fibrous glass ducts including manufacturer's fabrication and installation manual.

.3 Submit written inspection report of manufacturer's acceptance of fabrication and installation of fibrous glass ductwork. Confirm ductwork has been fabricated and installed in accordance with recommendations and SMACNA standards. Inspection shall occur at beginning of installation.

1.4 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, NFPA No. 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

2. PRODUCTS

2.1 MATERIALS

.1 Ducts: Galvanized steel lock forming quality, having galvanized coating to ASTM A653M, G90 designation for both sides.

.2 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.3 Sealant: Water resistant, fire resistive, compatible with mating materials.

2.2 FABRICATION

.1 Complete metal ducts with themselves with no single partition between ducts. Where width of duct exceeds 450 mm cross break for rigidity. Open corners are not acceptable.

.2 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.3 Construct tees, bends, and elbows with radius of not less than 1 1/2 times width of duct on centre line. Where not possible and where rectangular elbows used, provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibreglass inside.

.4 Increase duct sizes gradually, not exceeding 15 degree divergence wherever possible. Maximum divergence upstream of equipment to be 30 degree and 45 degree convergence downstream.

.5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

.6 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.

.7 Provide necessary baffling in mixed air plenums to ensure good mixed air temperature with variations of not more than ± 15°C under all operating conditions.

.8 Fabricate continuously welded medium pressure round and oval duct fittings of one gauge heavier than gauges indicated for duct size. Joints shall be 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints. Fabricate elbows of five piece construction. Provide standard 45° take-offs unless otherwise indicated where conical 90° tee take-off connections may be used. Adequately brace with truss couplings or comparison angle flanges with gaskets bolted at 150 mm centers.

.9 Fabricate plenums and casings to configurations shown on drawings. Construct plenums of galvanized panels joined standing seams on outside of casing riveted or bolted on approximately 300 mm centers. Reinforce with suitable angles and provide diagonal bracing as required. Tightly fit at apparatus and caulk with sealant.

.10 Reinforce door frames with angle iron tied to horizontal and vertical plenum supporting angles. Install hinged access doors where shown, specified or where required for access to equipment for cleaning and inspection.

.11 Fabricate acoustic plenums of galvanized steel. Provide 1.6 mm back facing and 0.8 mm perforated front facing with 3 mm diameter holes on 4 mm centers. Construct panels 75 mm thick packed with 72 kg/m3 minimum fibrous glass media, on inverted channels of 1.6 mm [on 75 mm reinforced concrete curb].

.12 Fabricate seams and joints in kitchen exhaust ducts liquid tight with continuous external welds.

3. EXECUTION

3.1 INSTALLATION

.1 Fabricate and install ductwork in accordance with SMACNA Duct Manuals, ASHRAE and Manitoba Building Code requirements and the requirements specified in this section.

.2 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pivot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.3 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.

3.2 LOW PRESSURE DUCT THICKNESSES (MINIMUM)

.1 Rectangular Ducts

Maximum Width	mm
Up to 300 mm	0.6
330 mm to 760 mm	0.8
790 mm to 1370 mm	0.8
1400 mm to 2130 mm	1.0
2160 mm and Over	1.2

.2 Round Ducts

Duct Diameter	mm
Up to 330 mm	0.6
350 mm to 550 mm	0.8
580 mm to 1270 mm	0.8
890 mm to 910 mm	1.0
1300 mm to 1520 mm	1.2
1550 mm to 2130 mm	1.6

3.3 MEDIUM PRESSURE DUCT THICKNESS

.1 Rectangular Ductwork

Maximum	mm
Up to 460 mm	0.8
480 mm to 1220 mm	0.8
1250 mm to 1830 mm	1.0
1850 mm to 2440 mm	1.2
2460 mm and Over	1.6

3.4 HIGH PRESSURE DUCT THICKNESSES

.1 Rectangular Ductwork

Maximum Width	mm
Up to 460 mm	0.8
480 mm to 1220 mm	1.0
1250 mm to 1830 mm	1.2
1850 mm to 2440 mm	1.6
2460 mm to 3660 mm	2.0

3.5 MEDIUM & HIGH PRESSURE DUCT THICKNESSES

.1 Round Ducts

	Spiral Lock Seam mm	Longitudinal Seam mm
Up to 200 mm	0.6	0.8
230 to 560 mm	0.8	0.8
580 to 910 mm	0.8	1.0
940 to 1270 mm	1.0	1.0
1300 to 1520 mm	1.2	1.2
1550 mm and Over	1.6	0.6

3.6 PLENUM GAUGES

.1 Fabricate fan plenums and plenums downstream of fan in accordance with duct gauges.

.2 Fabricate plenums upstream of fan between apparatus of 1.6 mm.

.3 Fabricate plenums upstream of filters of 1.2 mm

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

.1 Comply with requirements of Bid Opportunity 479-2024.

1.2 QUALITY ASSURANCE

.1 Fire dampers shall be UL listed and constructed in accordance with CAN/ULC-S112, Fire Test of Fire Damper Assemblies.

.2 Fusible links on fire dampers shall be constructed to ULC S505.

.3 Demonstrate resetting of fire dampers to authorities having jurisdiction.

.4 Access doors shall be UL labelled.

.5 Accessories shall meet the requirements of NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.6 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

.1 Access Doors: Acudor, Air-O-Metal, Lehage, Miami Carey, Milcor, Titus, Controlled Air, Ductmate

2.2 ACCESS DOORS

.1 Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and suitable quick fastening locking devices. Insulate with glass fibre insulation to same thickness as duct insulation and finish inside surface with suitable sheet metal cover frame for insulated ductwork.

.2 Fabricate with two butt hinges and two sash locks for sizes up to 450 mm, two hinges and two compression latches with outside and inside handles for sizes up to 600 x 1200 mm and an additional hinge for larger sizes.

.1 Rated Access Doors: rate access doors to the same rating as the fire rated assembly in which the door is installed. Provide ULC labelled doors.

2.3 BALANCING DAMPERS

.1 Fabricate of galvanized steel, minimum 1.6 mm, and provide with quadrants or adjustment rod and lock screw.

.2 Fabricate splitter dampers of double thickness sheet metal to streamline shape, properly stiffened to avoid vibration. Size on basis of straight air volume proportioning.

.3 Fabricate single blade dampers for duct sizes to 240 x 760 mm.

.4 Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 300 x 1800 mm. Assemble center and edge crimped blade in prime coated or galvanized channel frame with approved type hardware.

.5 Construct damper blades for medium and high pressure systems to block air passage 70% maximum. Provide complete with locking type handles.

.6 Fabricate multi-blade, parallel action gravity balanced backdraft dampers with blades a maximum of 150 mm width having felt or flexible vinyl sealing edges, linked together in rattle-free manner and with adjustment device to permit setting for varying differential static pressure.

2.4 TURNING VANES

.1 Standard Construction: full radius arc, single blade vanes.

.2 Acoustic Vanes: small arc airfoil vanes with fibrous glass packing, perforated 0.8 mm thick galvanized steel on inner arc.

2.5 RELIEF DAMPERS

.1 Construction: automatic multi-leaf steel or aluminum dampers with ball bearing and counterweights, adjustable to relieve static pressure required, maximum blade width 150 mm, flexible vinyl sealing edges.

3. EXECUTION

3.1 INSTALLATION

.1 Provide adequately sized access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Review locations prior to fabrication.

.2 Provide 100 x 100 mm quick opening access doors for inspection at balancing dampers and turning vanes.

.3 Provide 400 mm x 500 mm equipment access doors for servicing:

.1 fire dampers

.2 smoke dampers

.3 combination dampers

.4 automatic dampers

.5 duct coils (access door required both sides of coil)

.6 return air terminal boxes (at inlet)

.7 where required for cleaning, servicing or inspection of duct systems.

.4 Provide 600 mm x 1200 mm plenum access doors in plenums where total body entry is required to service mixing dampers, coils, filters, humidifiers and fans. Install 150 mm above floor. Arrange door swing so that fan static holds door in closed position.

.5 Provide fire dampers at locations indicated on drawings. Fire dampers shall be complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.

3.2 TURNING VANES

.1 Install full radius turning vanes in duct elbows where center line radius is less than 1.25 times width of duct.

.2 Install acoustic turning vanes in acoustic lined ductwork where center line radius is less than 1.25 times width of duct.

3.3 BACKDRAFT DAMPERS

.1 Provide gravity backdraft dampers on all exhaust air outlets to outdoor and exhaust fans where motorized dampers are not indicated, and where shown on drawings.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Bid Opportunity 479-2024 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2. PRODUCTS

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 MULTI-BLADED DAMPERS

.1 Applicable Equipment: FV-F601, FV-F602, FV-F603, FV-F604, FV-F605

.1 Location:

.1 Main floor: FV-F601, FV-F602, FV-F603, FV-F604, FV-F605

.2 Specified Equipment: FV-F601

.1 Dimension: 1016mm x 508mm
.2 Type: Low Leakage, thermally insulated
.3 Material: Extruded aluminum (6063T5)
.4 Blades: Internally insulated with expanded polyurethane foam and thermally broken
.5 Linkage: Installed in frame side and constructed of aluminum and corrosion resistant, zinc plated steel
.6 Operation: Modulating, Spring Return, Direct coupled
.7 UL listed and CSA certified
.8 c/w actuators and all required accessories

.1 Specified Actuators:
.1 Power supply: 24 VAC, 60 Hz
.2 Torque: 90 in-lb.
.3 Control Signal: 2-10 VDC modulating
.4 Running time: 95 sec. constant
.5 Operation: Modulating, spring return, fail open, direct coupled
.6 Supply multiple actuators where required to meet damper torque requirements as per manufacturer's recommendations.

.3 Specified Equipment: FV-F602, FV-F603

.1 Dimension: 406mm x 406mm
.2 Type: Low Leakage, thermally insulated
.3 Material: Extruded aluminum (6063T5)
.4 Blades: Internally insulated with expanded polyurethane foam and thermally broken
.5 Linkage: Installed in frame side and constructed of aluminum and corrosion resistant, zinc plated steel
.6 Operation: Modulating, Spring Return, Direct coupled
.7 UL listed and CSA certified
.8 c/w actuators and all required accessories

.1 Specified Actuators:
.1 Power supply: 24 VAC, 60 Hz
.2 Torque: 22 in-lb.
.3 Control Signal: 2-10 VDC modulating
.4 Running time: 95 sec. constant
.5 Operation: Modulating, spring return, FV-F602 fail open, FV-F603 fail closed, direct coupled
.6 Supply multiple actuators where required to meet damper torque requirements as per manufacturer's recommendations.

.3 Specified Equipment: FV-F604, FV-F605

.1 Dimension: 914mm x 914mm
.2 Type: Low Leakage, thermally insulated
.3 Material: Extruded aluminum (6063T5)

.4 Blades: Internally insulated with expanded polyurethane foam and thermally broken
.5 Linkage: Installed in frame side and constructed of aluminum and corrosion resistant, zinc plated steel
.6 Operation: On/off, Spring Return, Direct coupled
.7 UL listed and CSA certified
.8 c/w actuators and all required accessories

.1 Specified Actuators:
.1 Power supply: 24 VAC, 60 Hz
.2 Torque: 90 in-lb.
.3 Control Signal: 2-10 VDC modulating
.4 Running time: 95 sec. constant
.5 Operation: On/off, spring return, fail open, direct coupled
.6 Supply multiple actuators where required to meet damper torque requirements as per manufacturer's recommendations.

3. EXECUTION

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of the Contract Administrator.
.2 Inform the 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 the Contract Administrator.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible.

.7 Corrections and adjustments conducted by the Contract Administrator.

3.3 CLEANING

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

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

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

END OF SECTION

1. GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

.1 ANSI/AMCA Standard 99-2010, Standards Handbook.

.2 ANSI/AMCA Standard 210-2007/(ANSI/ASHRAE 51-07), 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.

1.2 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 HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide:

.1 Fan performance curves showing point of operation, kW and efficiency.

.2 Sound rating data at point of operation.

.2 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable as appropriate.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.1 Provide:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Bid Opportunity 479-2024 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect HVAC fans from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2. PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total and static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

2.2 FANS GENERAL

.1 Motors:

.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 For use with variable speed controllers.

.3 Sizes as specified.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment, inlet and outlet dampers and vanes and as indicated.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Finish on fume hood exhaust fans.

.6 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

2.3 GENERAL

.1 Statically and dynamically balance fans so no objectionable vibration or noise is transmitted to occupied areas of the building.

.2 Provide balanced variable sheaves for motors 10 kW and under.

.3 Fans shall be capable of accommodating static pressure variations of ±10% with no objectionable operating characteristics.

2.4 INLINE CENTRIFUGAL FANS

.1 General

- .1 Provide balanced variable sheaves for motors.
- .2 Motor shall have self-aligning ball or sleeve bearings with adequate lubricating arrangements.
- .3 Mountings shall be cast or die formed to smooth curves.
- .4 Hang fans off ceiling with hanging spring vibration isolators
- .5 Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

.2 Applicable Equipment: SF-F61, EF-F62, EF-F67

- .1 Location:
  - .1 Main floor: SF-L61, EF-L62, EF-F67
- .2 Specified Equipment: SF-F61, EF-F62
  - .1 Type: Inline Centrifugal
  - .2 Capacity: 1000 L/s at 124 Pa
  - .3 Voltage: 575 VAC
  - .4 Power: 373 Watt (1/2 hp)
- .3 Specified Equipment: EF-F67
  - .1 Type: Inline Centrifugal
  - .2 Capacity: 10420 L/s at 124 Pa
  - .3 Voltage: 575 VAC
  - .4 Power: 7457 Watt (10 hp)

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 the Contract Administrator.

.2 Inform the 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 the Contract Administrator.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings.

.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.

.5 Where inlet or outlet is exposed, provide safety screen.

.6 Provide belt guards on belt driven fans.

3.3 PRIMING

.1 Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

3.4 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

3.5 CLEANING

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

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

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

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.46-M1988(R2006), Electric Air-Heaters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-08, Enclosures for Electrical Equipment (1000 V Maximum).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

.4 Sustainable Design Submittals:

.1 Building Energy and Water Consumption: for monitoring of following end-uses submit copy of Measurement and Verification Plan following IPMVP.

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 Bid Opportunity 479-2024 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect unit heaters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2. PRODUCTS

2.1 UNIT HEATERS

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet

.2 Self-contained, ceiling mounted, factory-assembled unit complete with 20-gauge steel cabinet, louvered grill, and high-limit temperature control with automatic reset.

.3 Units shall come with adaptor for ceiling mount installation and control circuit and wall mount thermostat.

.4 Fan type unit heaters with built-in high-heat limit protection and fan-delay switches.

.5 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount.

.6 Hangers: as indicated.

.7 Elements: Tubular heating elements: stainless steel; finned steel

2.2 UNIT HEATER SCHEDULE

	UH-F63	UH-F64
Heat Output (kW)	20.0	25.0
Fan Output (l/s)	661	661
Electrical (Volt / Ph.)	600 / 3	600 / 3
Location	Main floor	Dry well
Accessories	Wall mounting bracket	Wall mounting bracket
	On/Off Relay with Transformer	On/Off Relay with Transformer
	Wall Mount 24 VAC Thermostat (TS-F631)	Wall Mount 24 VAC Thermostat (TS-F641)

2.3 DUCT HEATER SCHEDULE

	HCE-F66
Heat Output (kW)	40.0
Duct Size (mm)	508 x 508
Manufacturer	Thermolec
Electrical (Volt / Ph.)	600 / 3
Location	Main Floor
Accessories	SCR Controller to providing modulating control with 0 – 10V signal

3. EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Contract Administrator.

.2 Inform the 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 the Contract Administrator.

3.2 INSTALLATION

.1 Suspend unit heaters from ceiling or mount on wall as indicated.

.2 Install thermostats in locations indicated.

.3 Make power and control connections.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

3.4 CLEANING

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

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

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

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

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

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by unit heaters installation.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with 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.

.3 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the edition of the Canadian Electrical Code, Part I, CSA C22.1, and the variations made thereto by Manitoba regulation, which are in force on the date of bid closing for the Contract.

.4 All electrical products shall be tested, certified and labeled in accordance with a certification program accredited by the Standards Council of Canada (at a minimum, STANDATA Section 2 – Electrical System Equipment). Where a product is not so labeled, provide written approval by the authority having jurisdiction.

.5 Submit to The City, copy of electrical permit obtained from authority having jurisdiction.

.6 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.

.7 All equipment supplied to have 75°C termination ratings and suitable for connection of copper or aluminum conductors.

.8 All cable ampacities in the drawings and specifications are based on equipment termination ratings of 75°C. Should equipment be provided with a different rating it is the Contractors responsibility to size cable accordingly to meet the electrical code requirements.

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.

.4 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 Bid, in accordance with B4.

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 the necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Contract Document.

.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.

.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 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 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 Refer to City of Winnipeg Electrical Design Guidelines section 2.3 for Identification Lamacoid Requirements.

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 Plexiglass holder to be designed for the purpose and allow for easy replacement of the drawing.

.2 Size: 432 x 279 mm minimum size.

.1 Single Line Diagram

.2 Process P&ID

1.14 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

1.15 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centerline of equipment unless specified.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights.

.1 Panelboards: 1800 to top

.2 Light switches: 1420 to top

.3 Wall receptacles: 900 to top

.4 Control panels: 1800 to top

.5 Emergency lights: 2400 (minimum)

.6 Emergency stop switches: 900 to top

.7 Motor disconnect switches: 1800 to top

1.16 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.

1.17 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices 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.

1.18 TESTING

.1 All test instruments utilized are to have been calibrated within one year of the date utilized.

.2 Prior to energizing any portion of the electrical system, perform megger tests on all parts of the distribution system. Results shall meet the requirements of the CEC, authority having jurisdiction and the Contract Documents.

.3 Test results shall be consolidated into a typed report and included in the Operation and Maintenance Manuals.

1.19 SUBMITTAL

.1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division.

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification. At minimum the following should be included in each submission.

.3 Submit shop drawings, product data and samples of equipment and materials. Shop drawings to include but not be limited to the following:

.1 Complete product part numbers for each piece of equipment
.2 Corresponding equipment tag numbers with part numbers
.3 Product specification sheets indicating product features and options
.4 Dimensions in metric measurement (mm or meters)
.5 Weights in metric measurement
.6 Wiring/interconnection diagrams with manufacturer terminals numbers
.7 Any additional information requested by The City or The Citys representative

1.20 AS-BUILT MARKUPS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of As-Built Markups. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. As-Built Markups to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

.2 Provide red line as-built markups in pdf format to Contract Administrator. MPE will prepare Record Drawings based on the Contractor as-built markups.

.3 Record actual locations of all pull boxes, panelboards, luminaires, feeders, electrical equipment and electrical site services.

.4 Record any changes to circuit designations.

.5 Include on as-built markups, revisions due to engineering change orders, site alterations, additions and field ordered changes made during construction.

.6 Record any changes to control circuit wiring including but not limited to terminal numbering, wire and cable labels, interconnect wiring between equipment.

.7 Record any changes to schedules including panel, luminaire, mechanical, and conduit/cable schedules.

1.21 OPERATION AND MAINTENANCE DATA

.1 Provide the following for all systems and components:

.1 Manufacturer's product data, including performance curves, schematics, and wiring diagrams for all electrical control systems.

.2 Manufacturer's installation instructions.

.3 Manufacturer's operation instructions.

.4 Manufacturer's maintenance instructions, including complete parts list for all serviceable components.

.2 Provide a comprehensive list of subcontractors and suppliers who supplied and installed systems and components.

.3 Provide copies of all inspection certification reports from authorities having jurisdiction.

.4 Reference Section 40 05 01

1.22 COMMISSIONING

.1 Commission all instruments as described in Section 26 91 90 and 40 80 11.

.2 Retain the services of the equipment Manufacturers Technical Representative as required in each specification section.

.3 Upon completion of construction, all circuits are to be operational and all instruments operating within manufacturer's specifications.

.4 Prior to notifying The City’s Representatives Commissioning Team to begin commissioning activities, verify all control logic, inputs, and outputs, and complete Record Drawings as described in this section.

.5 Electrical controls, circuits and systems shall be tested by trial operation of control equipment after all wiring is completed to see that each interlock and control function operates in accordance with the contract drawings and the description of operation for the equipment. Where field conditions prevent actual equipment functioning during testing, the contractor shall simulate the intended operating condition in the associated control circuits.

.6 The contractor shall locate the cause of any malfunction and make the necessary wiring and / or equipment changes or corrections to obtain the particular systems intended operation as defined by the contract drawings. Such changes shall be included in the test report.

.7 Control Panels shall be operated through all design functions. This shall include remote operation of all equipment and actuation of alarms and indicating devices according to design requirements.

.8 Complete operation tests shall be given to all relays, and control devices to show that the equipment performs all design functions and meets design and procurement specifications.

.9 During start-up, assist Commissioning Team in debugging system operation and correct any deficiencies and omissions which appear.

1.23 AMBIENT ENVIRONMENT

.1 Unless otherwise indicated, supply equipment enclosures, boxes, electrical materials and products suitable for ambient environment of the following areas:

	Area	General Classification	Equipment Enclosure Type	Cable / Raceway
1.	Outdoor Areas	Wet	NEMA 4/NEMA 3R	Note 1
2.	Sewage Wet Well	Zone 1 (Division 1)	See CEC Section 18	PVC coated Rigid aluminum, TECK, See Note 2
3.	Dry Well	Ordinary	NEMA 12	Note 1

Note 1 Install cable or conduit type as per drawings.
Note 2 Seal all conduits with poured EYS conduit seals (or similar).

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 SECTIONS

.1 Section 26 05 01 – Common Works Results – For Electrical

.2 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 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.

.5 City of Winnipeg
- .1 Identification Standard – 510276-0000-40ER-0002.
- .2 Tag Naming Standard – 612620-0014-40ER-0001.
- .3 Electrical Design Guide – 5102786-0000-47ER-0001.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Contract Document.

Part 2 Products

2.1 BUILDING WIRES

.1 Wire: to CAN/CSA-C22.2 No. 38

.2 Conductors:

- .1 Size as indicated. Minimum size: 12 AWG.
- .2 Stranded for 10 AWG and larger.
- .3 Copper conductors.

.3 Voltage rating:

- .1 Circuits 480 V and less: 600 V
- .2 Circuits > 480 V: 1000 V
- .3 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.4 Colour coding to Section 26 05 01, wires sized 2 AWG and smaller to be factory-coded, taping will not be accepted.

2.2 TECK 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, 1000V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: polyvinyl chloride material.

.7 Fastenings:

.1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Cable Fittings:

.1 Watertight, approved for TECK cable.

.2 Hazardous Locations:

.1 CSA approved.

.2 Watertight type with:

.1 an elastomeric bevelled bushing.

.2 a funnel entry, splined gland nut.

.3 a non-magnetic, stainless steel grounding device with dual grounding action.

.4 a taper threaded hub.

.5 a hexagonal body and gland nut

.3 Integral seal type with metal-to-metal contact construction.

.4 Sealing of multi-conductor cable shall be accomplished with a liquid type polyurethane compound.

.5 The fitting must:

.1 Provide an environmental seal around the outer jacket of the cable and electrically bond the fitting to the cable armour prior to potting the explosion-proof seal.

.2 Allow the possibility of disconnection without disturbing the environmental seal, the electrical bonding or the explosionproof seal.

.6 All metal-clad cable fittings, for jacketed and non-jacketed interlocked armour cable, shall incorporate an easily removable armour stop.

.7 (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.

.8 Approved products:
.1 T&B Startech XP series or approved equal in accordance with B7.

2.3 VFD CABLE

.1 Cable to:

.1 CAN/CSA-C22.2 No. 38.

.2 CAN/CSA-C22.2 No. 174.

.3 CAN/CSA-C22.2 No. 230.

.2 Conductors:

.1 Grounding conductors: Three copper, symmetrically located in continuous contact with the copper tape shield or continuous aluminum armour.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000V.

.4 Shield: Continuous copper tape shield with 50% overlap or continuous (non-interlocked) aluminum armour.

.5 Armour: aluminum, interlocking or continuous.

.6 Overall covering: polyvinyl chloride material.

.7 Approved for six-pulse VFD use.

.8 Fastenings:

.1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.9 Connectors:

.1 Watertight, approved for the cable.

2.4 600V TECK90 CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Grounding conductor, copper.

.3 Conductors, copper, size as indicated.

.4 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 600V.

.5 Armour: interlocking aluminum

.6 Shielding as indicated on the drawings.

.7 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.

.8 Overall covering: thermoplastic polyvinyl chloride material.

.10 Fastenings:

.1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.11 Connectors:

.1 Watertight, approved for the cable.

2.5 300V ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 Conductors, copper, size as indicated. 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

.3 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.4 Twisted pairs/triads cabled with staggered lays

.5 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100% shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.6 Armour: interlocking aluminum

.7 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.8 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.

.12 Fastenings:

.1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.13 Connectors:

.1 Watertight, approved for the cable.

2.6 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 01 – Common Work Results

Part 3 Execution

3.1 GENERAL

.1 Do not splice cables. A continuous length is required for all feeds.

.2 Install in accordance with manufacturer's recommendations, observing requirements for minimum bending radius and pulling tensions.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install in conduit as per Section 26 05 34.

3.3 INSTALLATION OF ARMOURED CABLE AND TECK CABLE 0 -1000 V

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 - 1000 V.

.3 Where surface mounted, provide clamps spaced a maximum of 1 m apart.

.4 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.

.5 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.

3.4 INSTALLATION OF CONTROL CABLES

.1 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.

.2 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.

.3 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.

3.5 TERMINATIONS AND SPLICES

.1 Wire nuts are permitted only in the following circuits:

.1 Lighting circuits.

.2 Receptacle circuits.

.2 Exercise care in stripping insulation from wire. Do not nick conductors.

.3 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

.4 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.

3.6 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.

3.7 CABLE INDENTIFICATION

.1 Install cable tags.

3.8 TESTING

.1 Test all power conductors 10 AWG and larger in accordance with 26 08 05.

END OF SECTION

Part 1 General

1.1 NONE

.1 None.

Part 2 Products

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.1 Conduit support structures shall employ an aluminum strut framing system together with the manufacturer's connecting components and fasteners for a complete system.

.2 Finishes:

.1 Wet locations: Aluminum.

.2 Indoors/ inside panels, dry locations: Aluminum.

.3 Nuts, bolts, machine screws: 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.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and 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, 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 aluminum straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole aluminum straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels, with maximum centre spacing as indicated above.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.14 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

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

1.3 SUBMITTALS

.1 Provide submittals in accordance with Contract Document.

.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 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Type and size as indicated on the drawings, or sized as per code requirements

.4 Utilize stainless steel or PVC construction for NEMA 4X junction and pull boxes

2.2 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Install terminal blocks as indicated in Type T cabinets.

.5 All enclosures shall suit the environment where they are installed as follows:

.1 CSA/ NEMA 1 metal enclosures when installed inside panel

.2 CSA/ NEMA 3R (WP) metal enclosures when installed outdoors

.3 CSA/ NEMA 7 (XP) metal enclosures when installed in hazardous classified areas.

.6 Refer to specification 26 05 01 for further details.

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: F73-2 (Panel F73, circuit 2)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Medium-voltage, metal-clad switchgear and its associated auxiliary equipment. The equipment shall consist of indoor switchgear with horizontal draw out, vacuum circuit breakers.

1.2 REFERENCES

1. ANSI/IEEE C37.20.2 - Metal-Clad Switchgear
2. ANSI/IEEE C37.04 - Rating Structure for High-Voltage Circuit Breakers
3. ANSI/IEEE C37.06 - Preferred Ratings for High-Voltage Circuit Breakers
4. ANSI/IEEE C37.90 - Relays and Relay Systems.

1.4 SUBMITTALS

.1 Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by purchaser name, purchaser location and purchaser's order number.

.2 Approval documents shall include the following at minimum:

.1 General arrangement drawing showing dimensioned elevation and floor plan, foundation details and single-line diagram.
.2 Panel arrangement drawing showing layout of devices on the panel doors
.3 Three-line diagrams
.4 Schematics
.5 Nameplate engraving drawings
.6 Electrical bill of material.

.3 Final documents shall include the following at minimum:

.1 Documents listed in Specification section 1.3.2 above.
.2 Wiring Diagrams
.3 Recommended spare parts list for start-up support
.4 Operations and Maintenance instructions

1.3 QUALITY ASSURANCE

.1 Comply with requirements of latest revisions of applicable industry standards, specifically including those outlined in Section 1.2.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver in convenient shipping groups.

.2 Circuit breakers shall be shipped inside their respective cells.

.3 The shipping groups will be connected together in the field by the contractor.
.4 The accessory cabinet shall be shipped attached to the switchgear.

.5 Bus bars with associated hardware for connections between shipping groups shall be shipped attached to the switchgear in the approximate locations where they shall be needed.

.6 Contractor shall store the equipment in accordance with manufacturer's recommendations.

.7 Contractor shall install temporary heaters, if necessary, to prevent condensation during storage.

.8 Contractor shall handle and move the switchgear in accordance with manufacturer's recommendations.

Part 2 Products

2.1 MANUFACTURERS

.1 The metal-clad switchgear assembly basis of design is Strong Electric, allowed manufacturers will be as follows:

.1 Strong Electric
.2 Schneider
.3 Eaton
.4 GE

2.2 RATINGS

.1 System configuration: The switchgear shall be suitable for application in three-phase, 60 Hz high-impedance grounded system.

.2 Electrical ratings:

.1 Disconnect and switchgear ratings shall be based on "constant kA" ratings and ANSI/IEEE C37.04-1999.
.2 Interrupting class: 65 kA
.3 Maximum design voltage (V): 4160 V
.4 Impulse withstand voltage: 60 kV
.5 Interrupting current (I) at maximum design voltage: 65 kA
.6 Voltage range factor (K): 1.0
.9 Switchgear main bus continuous current 400 A

2.3 SWITCHGEAR GENERAL CONSTRUCTION

.1 The maximum dimensions of the switchgear enclosures shall be as follows:

.1 SGR-F70
.1 Height: 2300 mm
.2 Width: 2000 mm
.3 Depth: 1300 mm

.2 The switchgear enclosure shall be of metal-clad construction, the construction shall be self-supporting and freestanding. All metal work shall be free from burrs and sharp edges.

.3 Install remote metering cabinet to the side of the switchgear enclosure for Manitoba Hydro metering and termination of metering transformers.

.3 Furnish Lamacoid Nameplates for each cell: 3mm thick plastic engraving, black face, white

core, and mechanically attached, size: 25mm high with 12 mm high letters.

.4 The switchgear shall be factory assembled and tested in convenient shipping groups and tested. The switchgear shall be of a coordinated design so shipping groups shall be easily connected together at the site into a continuous lineup. Necessary shipping split connecting bus bars, boots and hardware shall be furnished and shall be attached to the switchgear in the approximate locations where they will be needed.

.5 The switchgear assembly shall be service entry rated and consist of two vertical sections side by side, with a rear section for load terminations. The sections shall be arranged for (1) line side entry and disconnect, (2) utility metering, and (3) load termination.

.7 The ground bus shall be bare tin-plated copper and shall extend the full length of switchgear.

.11 IR windows to allow for thermal inspection of bussing and connection/termination points

2.4 COMPONENTS

.1 Instrument transformers: Comply with ANSI/IEEE C57.13 and ANSI/IEEE C37.20.2.

.1 Metering transformers to be provided by Manitoba Hydro. The metering section must be approved and comply with Manitoba Hydro metering standards.

2.5 ACCESSORIES

.1 Provide the following accessories:

.1 Six spare fuses of each type and rating of fuse used. Include spares for voltage transformer fuses and control power fuses.
.2 One spare indicating lamp of each type installed.
.3 ½ pint of touchup paint matching enclosure finish.

3. EXECUTION

3.1 INSTALLATION

.1 General: Electrical contractor or switchgear installer shall install switchgear in accordance with manufacturer’s written instructions and the following specifications.

3.2 INSPECTION

.1 Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture’s recommendations. Check all installed switchgear for proper grounding, fastening and alignment.

3.3 FIELD QUALITY CONTROL

.1 Visually inspect for physical damage.

.2 Perform site tests as specified in manufacturers’ instruction manuals.

.3 Touch-up paint to repair any damaged surfaces using manufacturer-furnished paint. Leave

remaining touch-up paint with the City.

.4 Verify operation of interlocks.

.5 Perform power-frequency withstand voltage tests in accordance with ANSI/IEEE C37.20.2, clause 6.5.

.6 Remove debris from switchgear and wipe dust and dirt from all components.

3.4 WARRANTY

.1 Equipment manufacturer shall warrant that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than 18 months from date of shipment.

3.5 START-UP SERVICE

.1 Switchgear manufacturer shall provide a factory-authorized service technician for the purposes of operations and maintenance training.

.2 Procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance.

.3 Review data in the instruction manuals. Refer to Section 01 78 00- Closeout Submittals.

.4 Schedule training with the City with at least three week's advance notice.

3.6 FIELD SERVICE

.1 Service and Parts facilities located in the province of Manitoba with 24 hours service, experienced in the installation and operation of all switchgear components.

3.7 TRAINING

.1 The Contractor shall provide a training session for 4 City's Representative(s) for up to 1 day (8 hours) at the jobsite location where the equipment is installed.

.2 The training session shall be conducted by a manufacturer's qualified representative and include instructions on assembly, maintenance, and other major components.

3.8 WITNESS TESTING

.1 A review of the electrical and mechanical drawings for the purchased equipment will be done with the supplier's representative prior to commencement of the witness test. Any questions or clarifications will be addressed at this time. The supplier representative will also review what will occur during the witness test.

.2 The witness test will be broken down into two individual elements:
.1 Equipment physical inspection
.2 Electrical inspections

.3 Supplier's technician to be supplied for a minimum of 1 day for commissioning

.4 The witness testing will take place both on site (commissioning), as well as at the

production facility (Factory Acceptance). The Contractor will bear the cost to transport and accommodate two City's representatives, and Contractor representative(s) to the production facility.

3.9 PHYSICAL INSPECTION

.1 The physical inspection will include, but is not limited to the following items:

.1 Ensure all power and ground bus connecting hardware is present and labeled.

.2 Ensure correct engraving of unit and master nameplates

.3 Equipment physical layout and dimensions verified against engineering documentation

.4 All components are verified against engineering documentation to be present and correctly installed

.5 Warning nameplates, isolation barriers, and mechanical interlocks must provide sufficient safety/isolation for personnel and equipment

.6 Verify operation of isolation switch handle and door interlocks Electrical Inspection

3.10 ELECTRICAL INSPECTION

.1 The electrical inspection will include but is not limited to the following items:

.1 A Hi-Pot dielectric withstand test is performed on all bus work and power cables from phase-to-phase and phase-to-ground

.2 Control power at the rated voltage is applied to the equipment, and a functional demonstration of customer purchased options and control devices is completed

.3 Instruments, meters, protective devices, and associated controls are functionally tested by applying the specified control signals, current and/or voltages

.4 The operation of the vacuum contactor(s) and circuit breakers and disconnects are demonstrated

.5 Networking and communications system operation, where applicable

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-21, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Material Requirements:

.1 Main Floor & Drywell: PVC

.2 Wetwell: Metal

2.2 SURFACE MOUNTED OUTLET BOXES FOR METAL CONDUIT

.1 General Requirements:

.1 Acceptable materials:

.1 Cast Aluminum

.2 Cast ferrous alloy with corrosion resistant epoxy coating.

.2 Finish: Epoxy Enamel

.3 Suitable for threaded rigid conduit

.4 Mounting lugs as required.

.5 Wet location covers for all locations unless otherwise approved by the Contract Administrator.

.6 To CSA 22.2

.2 Specific Requirements:

.1 In Panel Outlets:

.1 Crouse Hinds VXF/VFT series

.2 Round Boxes:

.1 100mm (4") round.

.2 Tapped conduit openings and plugs.

.3 Manufacturer / Model:

.1 Crouse Hinds VXF series

.2 Or approved equal in accordance with B7.

.3 Device Boxes:

.1 Crouse Hinds FS/FD series with factory threaded hubs and mounting feet for surface wiring of receptacles.

.2 Single gang unless specified otherwise.

.3 Wet location covers for all locations below grade.

.4 Manufacturer / Model:

.1 Crouse Hinds FS/FD series

.2 Or approved equal in accordance with B7.

.5 Device Boxes in classified areas:

.1 Crouse Hinds 'explosion-proof' rated.

2.3 SURFACE MOUNTED OUTLET BOXES FOR PVC CONDUIT

.1 General Requirements:

.1 To CSA 22.2 No. 18.

.2 Acceptable Materials: PVC

.3 Grounding Stud

.4 Mounting lugs as required

.5 NEMA 4X, unless otherwise indicated

.2 Specific Requirements

.1 Ceiling Outlets:

.1 IPEX OB series

.2 Or approved equivalent in accordance with B7.

.2 Device Boxes:

.1 IPEX FX/FD series

.2 Or approved equivalent in accordance with B7.

2.4 CONDUIT BOXES FOR PVC CONDUIT

.1 Non-metallic PVC boxes with mounting feet for surface wiring of devices.

.2 Acceptable products:

.1 Ipex

.2 Or approved equal in accordance with B7.

2.5 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.6 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.7 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices in Panels.

2.8 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.9 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 All boxes for outlets and devices shall suit the environment where they are installed as follows:

.1 CSA/ NEMA 1 metal enclosures when installed inside panel

.2 CSA/ NEMA 3R (WP) metal enclosures when installed outdoors

.3 CSA/ NEMA 7 (XP) metal enclosures when installed in hazardous classified areas.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work. Vacuum clean interior of outlet boxes before installation of wiring devices.

.4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.6 Provide permanent label or lamacoid for all device boxes indicating the circuit(s) contained within.

.1 Example: F73-2 (Panel F73, circuit 2)

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 CAN/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 (Unplasticized) Conduit.

.5 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT) and Fittings (Binational Standard, with UL 1696).

1.2 SUBMITTALS

.1 Provide submittals in accordance with Contract Document.

.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 CONDUITS

.1 Minimum conduit size: 19 mm, unless specifically indicated on the drawings or approved by the Contract Administrator.

.2 Rigid metal conduit: to CSA C22.2 No. 45.1, aluminum, threaded,

.3 Electrical Metallic Tubing CAN/CSA C22.2 No. 83, aluminum threaded.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.5 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.6 PVC coated Rigid Aluminum: to CSA C22.2 No. 45.1

.7 PVC coated Rigid Aluminum: to CSA C22.2 No. 45.1

2.2 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 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 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.

2.4 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Utilize insulated grounding bushings at all enclosure entries.

.4 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene

Part 3 Execution

3.1 ROUTING

.1 Locate conduits containing communication and low voltage conductors away from conduits containing power wiring.

.2 Avoid routes that would interfere with any potential maintenance activities such as but not limited to:

.1 Roof hatches.

.2 Mechanical Dampers.

.3 Building/Equipment door openings.

.4 Equipment Monorails.

.3 Where not specifically shown in detail on the drawings, review proposed conduit routing with Contract Administrator prior to installation. Comply with all routing changes requested by the Contract Administrator.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits in finished areas.

.3 Surface mount conduits in mechanical and electrical service rooms and in unfinished areas.

.4 Use rigid aluminum threaded conduit except where specified otherwise.

.5 Minimum conduit size for lighting and power circuits: 19 mm.

.6 Mechanically bend steel conduit over 19 mm dia.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.9 Dry conduits out before installing wire.

.10 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.

.11 Ensure electrical continuity in all conduit systems.

.12 All conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.

.13 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 hazardous classified areas with approved seals.

.14 EYS seal conduits after explosion-proof boxes towards unclassified areas. Add Chico compound to stop migration of hazardous gases only after all tests and commission is successfully done.

.15 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.

.16 Install fish cord in empty conduits.

.17 Install ground wire in all conduits. Size ground wire as per CEC Table 17.

.18 Underground conduits: Slope conduits to provide drainage, use waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.3 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 Provide a separate ground wire within rigid conduit, bonded to motor frames and system ground.

7 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 CEC Category 1 or 2:

.1 Drywall / Wood surfaces: no space required

.2 Masonry / concrete surfaces: 6 mm

.2 Below grade spaces: 12 mm

3.4 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 below, table 4-5 of the CoW Electrical Design Guide.

Table 4-5 : Conduit Colour Bands

System	Prime Band	Aux. Band
Medium Voltage (> 750 V)	Orange	
347/600 V	Yellow	
208/120/240 V Power	Black	
UPS 208/120/240 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
Grounding	Green	
Fibre Optic Cable	Purple	

3.5 PVC CONDUIT

.1 Concrete Penetrations:

.1 Seal and fire stop penetration around conduit with CSA 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

3.6 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 Aluminum Conduit

.1 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

3.7 LIQUID-TIGHT AND EXPLOSION-PROOF FLEXIBLE CONDUIT

.1 Use as LT raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water when located in non-classified areas.

2 Use as XP raceways at all motors, pipe-mounted control devices, and other devices subject to movement when located in classified areas.

.3 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.

.4 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.8 CONCEALED CONDUIT

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.9 CONDUIT IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.10 CONDUIT IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.11 INSTALLATIONS IN CATEGORY 1 AND 2 LOCATIONS

.1 As per CEC section 22.

.2 Arrange to provide drainage at frequent intervals to suitable locations.

.3 Equip with approved fittings to permit the moisture to drain out of the system.

.4 Install the conduit with a minimum of 12 mm space from the supporting surface.

.5 Install every joint to be water-tight.

.6 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.

3.12 INSTALLATIONS IN HAZARDOUS ZONE 1 AND 2 LOCATIONS

.1 Explosion proof conduit sealing fittings:

.1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.

.2 Add sealing compound following manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 190 mm planks pressure treated, water repellent preservative.

Part 3 Execution

3.1 DIRECT BURIAL OF DUCTS IN TRENCHES

.1 After sand base in trenches is in place, lay ducts maintaining 75 mm clearance from each side of trench to nearest cable. Maintain a burial depth of 1M throughout its length. Do not pull ducts into trench.

.2 Provide offsets for thermal action and minor earth movements.

.3 Minimum permitted radius 6 times diameter of ducts or in accordance with manufacturer's instructions.

.4 Duct separation:

.1 As shown on drawings.

.5 After sand protective cover specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, install continuous row of 38 x 190 mm pressure treated planks as indicated to cover length of run.

3.2 CONCRETE ENCASED DUCTS IN TRENCHES UNDER VEHICULAR AREAS

.1 Follow steps 1 thru 5 as stated in item 3.1 above.

.2 Concrete encase with top and bottom reinforcements all ducts when running under or crossing vehicular traffic/ paved roadway areas

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 NETA ATS-2017, Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, 2017 Edition

1.2 TESTING REPORT

.1 Prepare an overall inspection and test report that details all investigations and tests.

.2 The Contractor shall furnish five paper copies and two electronic copies on CD of each final report.

.1 The electronic copies of the report, including the test forms, shall be provided in PDF format.

.2 The Microsoft Word version of the all completed test forms provided to the Contractor shall also be included on the CDs.

.3 The report shall be neat and organized. Any omissions, inconsistencies, or incomplete work identified by the Contract Administrator shall be corrected and incorporated into the report in the appropriate section, and completely resubmitted.

.4 A draft of each report shall be completed and sent to the Contract Administrator for review a maximum of one month after the completion of the inspections at the Site.

.5 The final report shall be submitted a maximum of two weeks after the Contractor receives the mark-up of the draft report from the Contract Administrator.

.6 The report shall include the following:

.1 Summary of project.

.2 Testing Equipment.

.3 Detail the type, manufacturer, model, and last calibration date of all testing equipment.

.4 Description of equipment tested.

.5 Description of all tests.

.6 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.

.7 Itemized list of all repaired deficiencies which shall include:

.1 Detailed description of the deficiency.

.2 The cost associated with the deficiency repair.

.8 Itemized list of all un-repaired deficiencies encountered which shall include:

.1 Detailed description of the deficiency.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 SCOPE OF TESTING

.1 SGR-F70

.2 XFMR-F70

.3 CDP-F70

.4 MCC-F71, including:

.1 Surge Protector

.2 Power Meter

.3 Power fail relay

.4 CTs

.5 PTs (if present)

.6 VFD – Cooling Fan

.7 Soft Starters – Pumps

.8 Motor Starter – HVAC

.9 Breakers

.5 XFMR-F73 and PNL-F73

.6 Motors, pumps

.7 Motors, HVAC

.8 Perform a harmonics measurement, at the following locations:

.1 CDP-F70 incoming feed.

3.2 INSPECTION, TESTING AND MAINTENANCE PROCEDURES

.1 General

.1 All tests are based on NETA (InterNational Electrical Testing Association) standard ATS-2003. Where manufacturer's specifications, tolerances, and/or published data are not available, refer to the appropriate tables in ATS-2003.

.2 Torque all accessible bolted electrical connections. Additional requirements apply as specified.

.3 Utilize all 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 report.

.8 Where corrections or repairs are made, record both as found/as left test readings on the inspection sheet. 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 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 report.

.8 The inspection forms may be updated during the Work by the City or Contract Administrator. Utilize the latest forms provided.

.9 Perform insulation resistance temperature correction calculations.

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 SURGE ARRESTORS, LOW VOLTAGE

.2 Inspection and testing shall be comprised of the following:

.1 Inspect physical and mechanical condition.

.2 Inspect anchorage, alignment, grounding, and required clearances.

.3 Clean the unit.

.4 Verify that arrestors are electrically connected in their specified configuration.

.5 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.

.6 Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

.7 Verify that stroke counter, if present, is correctly mounted and electrically connected.

.8 Perform insulation-resistance tests for one minute from each phase terminal to the case.

.9 Equipment rated >= 600V, utilize a test voltage of 1000 VDC.

.10 Equipment rated < 600V, utilize a test voltage of 500 VDC.

.11 Test the grounding connection. Resistance between the arrester ground terminal and the ground system should be less than 0.5 ohm.

3.5 METERING DEVICES, DIGITAL

.3 Inspection and testing shall be comprised of the following:

.1 Inspect physical and mechanical condition.

.2 Torque all bolted connections

.3 Record the equipment nameplate data for inclusion in the report.

.4 Verify accuracy of voltage and current at a minimum of two points each.

.5 If required, calibrate meters in accordance with manufacturer's published data.

3.6 MOTORS, INDUCTION, AC, 600 V

.4 Inspection and testing shall be comprised of the following:

.1 Prepare and submit a condition report of existing pump motors to the contractor administrator.

.2 Note the equipment nameplate data for inclusion in the report.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage, alignment, and grounding.

.5 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.

.6 Clean the unit.

.7 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.

.8 Verify the application of appropriate lubrication and lubrication systems.

.9 Verify the absence of unusual mechanical or electrical noise or signs of overheating.

.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 Correct test results to 40 °C.

.5 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.

.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

.5 Inspection and testing shall be comprised of the following:

.1 Note the equipment nameplate data for inclusion in the 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 CIRCUIT BREAKERS, INSULATED CASE/MOLDED CASE, 600 V

.1 Inspection and testing shall include the following:

.1 Note the equipment nameplate data for inclusion in the 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.

3.9 TRANSFORMERS, LOW VOLTAGE, DRY-TYPE

.1 Inspection and testing shall be comprised of the following:

.1 Note the equipment nameplate data for inclusion in the report.

.2 Inspect physical and mechanical condition.

.3 Inspect anchorage, alignment, and grounding.

.4 Clean the unit.

.5 Torque all accessible bolted power connections.

.6 Record the tap setting.

.7 Perform insulation-resistance tests winding-to-winding and each winding-to ground. Duration of the test is to be one minute. Calculate the dielectric absorption ratio.

.1 600 V windings shall be tested at 1000 Vdc.

.2 120/208 V windings shall be tested at 500 Vdc.

3.10 TRANSFORMERS, MEDIUM VOLTAGE

.1 Refer to Section 26 12 17.02 - Liquid Filled Transformers

3.11 PANELBOARDS, LOW VOLTAGE

.1 Inspection and testing shall be comprised of the following:

.1 Note the equipment nameplate data for inclusion in the report.

.2 Inspect physical and mechanical condition.

.3 Inspect anchorage, alignment, and grounding.

.4 Clean the unit.

.5 Inspect breakers and verify mechanical operation by exercising all circuit breakers.

.1 Record breaker data on the inspection form.

.2 Test all breakers utilizing the “Push-To-Trip” button, if equipped.

.3 Move operating handle to the off and on position.

.4 Restore breaker position to original position.

.6 Test main and feeder/load breakers with a frame size >= 250A, or with long, short, or ground fault settings and complete a separate inspection form for each.

.7 Torque all accessible bolted power connections including incoming, load neutral and ground connections.

.8 Perform insulation-resistance tests on each bus phase with all other phases grounded.

.9 The main breaker, if present, is to be open for the test. If no main breaker is present, disconnect the supply conductors.

.10 Open all load breakers.

.11 Test voltage for all 600/347 V panelboards to be 1000 Vdc.

.12 Test voltage for all 120/208 V panelboards to be 500 Vdc.

3.12 GROUNDING SYSTEM

.1 Inspection and testing shall be comprised of the following:

.1 Perform resistance tests between the main grounding electrode and grounded points in the electrical distribution system located in the CDP, MCC, 5kV switchgear, etc. including the lift station grounding point after reconnection. Investigate connections with a resistance greater than 0.5 milliohms.

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.

.3 CAN/CSA-C802.2-18, Minimum Efficiency Values for Dry Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

.3 Canada’s Energy Efficiency Act and Energy Efficiency Regulations

1.3 PRODUCT DATA

.1 Submit product data in accordance with Contract Document including:

.1 manufacturer's instructions,

.2 printed product literature,

.3 data sheets,

.4 performance criteria,

.5 physical size,

.6 Finish,

.7 limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store and protect dry type transformers from nicks, scratches, and blemishes.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 TRANSFORMERS

.1 XFMR-F73

.1 Type: ANN.

.2 Three phase, 15 kVA, 600V input, 120/208 V output, 60 Hz.

.3 Voltage taps: 2.5% 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): standard.

.8 Hipot: standard.

.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 17 degrees C: standard

.11 Mounting: floor mounted as per drawings.

.12 Nameplate to include actual transformer impedance (%Z).

.13 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 Indicate equipment identifier, KVA rating, primary and secondary voltage.

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers up to 75 kVA. 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 and in the bottom 1/3 of transformer enclosure.

.10 Energize transformers after installation is complete.

.11 Adjust tap connections to give a continuous secondary voltage of 120 volts phase to neutral, under load.

3.2 TESTING

.1 Utilize test form provided. Complete test form in full.

.2 Perform an insulation-resistance test. Individually test each winding with all other windings grounded, and test winding to winding, with both windings ungrounded. The test voltage shall be 1000 VDC, unless otherwise indicated by the manufacturer. The test duration shall be one minute.

.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.

3.3 CLEANING

.1 Progress Cleaning:

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

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

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by dry type transformers installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for liquid filled transformers larger than 500KVA and under 161kV primary including equipment identification and transformer installation.

1.2 REFERENCES

.1 National Electrical Manufacturers Association (NEMA)

.2 Canada's Energy Efficiency Act and Energy Efficiency Regulations

.3 ANSI/IEEE C57.12.00-2006 Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers

.4 ANSI/IEEE C57.12.90-2006 Standard Test Code for Liquid-Immersed Distribution, Power and Regulating Transformers

.5 ANSI/IEEE C57.98, Impulse Tests, Guide for Transformer (Appendix to ANSI/IEEE C57.12.90)

.6 ANSI/NFPA 70, National Electrical Code

.7 ASTM D877 - Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

.8 CSA C-88

1.3 PRODUCT DATA

.1 Submit Shop Drawings in accordance with Contract Documents including:

.1 Transformer nameplate drawing including:

- Manufacturer's name
- Table with voltage, power and current for each tap position
- Rated frequency in Hz
- Primary, secondary Basic Impulse Level (BIL)
- Winding configuration diagram
- Self-cooled (ONAN) rating at rated temperature in kVA
- Forced air-cooled rating (ONAF) in kVA
- Full load temperature rise
- Full load currents
- Rated impedance
- Weights (filled & empty, core & coil, tank & fittings)
- Dimensions of transformer and accessories

- Dimensions for mounting base
- Type of liquid
- Liquid volume
- Winding material
- Maximum and minimum internal operating pressures
- Transformer tag number
- Standard to which unit is built

.2 Transformer plan and elevation views showing detailed dimensions, weights, center of gravity, and component locations.

.3 Schematic diagrams and wiring diagrams showing all interconnections and their functions for all auxiliary control and protective devices. IEEE symbols shall be used. Diagrams to be job specific and modified to include all relavent project interconnections.

.4 Terminal connection diagram for all electrically connected equipment including recommended connection torque requirements. Terminals shall be clearly marked and identified.

.5 AutoCAD files (.dwg or .dxf) for all transformer dimensional and wiring diagrams for use in the final record drawing package.

.2 Submit product data in accordance with Contract Document including:

.1 Manitoba Hydro Approval,

.2 manufacturer's instructions,

.3 printed product literature,

.4 data sheets,

.5 performance criteria,

.6 Bill of material,

.7 Predicted and actual transformer losses and impedance values,

.8 Regulation and efficiency calculations at rated load and rated frequency. Regulation shall be stated at both 0.8 and 1.0 power factor. Efficiency shall be stated at ¼, ½, ¾ and full load on the base rating and on the highest forced cooled rating.

.9 Field service rates,

.10 Recommended spare parts including prices, quantities and manufacturer’s part numbers,

.11 Instructional manuals for individual components such as contactors, relays, gauges, etc.

.12 List of Vendor's standard tests and testing methods,

.13 List of additional tests Vendor can provide,

.14 Certified test results,

.15 physical size,

.16 Finish,

.17 limitations.

.3 Transformer supplier to provide harmonic analysis based on connected distorting loads on the main bus. Transformer supplier to indicate in writing their findings and recommendation if a higher "K" factor rated transformer is required.

1.4 FACTORY CERTIFIED TESTS AND WITNESS TESTING

.1 A certified test report shall be submitted for the transformer being supplied. The transformer serial number shall be noted in the report. The following factory certified tests shall be performed:

.1 No-Load (85 degrees C) losses at rated voltage.
.2 Total (85 degrees C) losses at rated current.
.3 Percent Impedance (85 degrees C) at rated current.
.4 Excitation Current (100 percent voltage) test.
.5 Winding Resistance measurement tests for each winding at the rated voltage tap.
.6 Ratio Tests using all tap settings.
.7 Polarity and Phase relation tests.
.8 Induced potential tests.
.9 Full wave and Reduced wave impulse test.
.10 Applied potential test shall be made on all high and low voltage windings to ground.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for transformers for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

.2 Inspect and report concealed damage to carrier within specified time.

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

.4 Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. (Heat enclosures to prevent condensation.)

1.7 WARRANTY

.1 Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of purchase, whichever occurs first.

1.8 OPERATION AND MAINTENANCE DATA

.1 All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS and specification Section 01790.

1.9 SOURCE OF SUPPLY

.1 All transformers to be assembled and shipped from withing North America. Supplier to have support staff capable of servicing equipment on site within 72 Hours' notice.

Part 2 Products

2.1 TRANSFORMERS

.1 XFMR-F70

.1 Transformer shall be outdoor secondary unit substation type from incoming line terminals to outgoing feeder terminals.

.2 Primary terminations shall be side-wall mounted for: close-coupling to high voltage switchgear or cable connections in air-filled terminal chambers. Bushing cable connections to be fed from underground

.3 Secondary terminations shall be side-wall mounted for: close-coupling to low voltage switchgear or busway or cable connections in air-filled terminal chambers. Bushing cable connections to be fed from underground

.4 Type: ONAN/ONAF.

.5 Three phase, 1000 kVA, 4160V input, 600V output, 60 Hz.

.6 Delta/Wye connections.

.7 Impedance at full MVA: approximate 6% (ONAN).

.8 Windings: copper.

.9 Mounting: Pad mounted

.10 Nameplate to include actual transformer impedance (%Z).

.11 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.2 RATINGS

.1 Unless otherwise stated, the transformer (MVA), short circuit withstand and BIL ratings shall be in accordance with ANSI standards.

.2 The Transformer shall be designed and constructed to withstand without damages the mechanical and thermal stresses produced by three phase, single line to ground, double line to ground and line to line faults on the transformer terminals

.3 The transformer shall be capable of operating at rated MVA without exceeding winding temperature recommended maximum.

.4 Transformer BIL levels shall comply with ANSI Standard ANSI/IEEE C57.12.00.

.5 Equipment and apparatus shall be rated for +/-10% voltage and +/-5% frequency ratings.

.6 Total Harmonic Distortion (THD) of the supply network voltage will not exceed 5%.

.7 Transformers shall be rated for 65 degree C temperature rise (ONAN)

2.3 WINDINGS AND CONNECTIONS

.1 Unless otherwise stated, transformers shall be delta primary, wye secondary with the low voltage phasor lagging the high voltage phasor by a phase angle of 30 degrees.

.2 Transformer windings shall be copper.

.3 Scott connected or T-connected transformers are not allowed.

.4 A core bushing is required.

.5 Provide NEMA 2-bolt compression lugs for cable connections. LV bushings throat shall be suitable to connect either cable or bus duct.

.6 Coils to be circular (disc) type to be neatly wound under tension, utilizing adhesive-coated electrical grade insulating paper between LV and HV windings. Rectangular coils will not be acceptable

2.4 ENCLOSURE

.1 Sealed tank designs shall be provided for all transformers. where the transformer capacity will allow. Inert gas systems are not acceptable.

.2 Transformer shall be constructed of high-grade, grain oriented, silicon steel laminations, with high magnetic permeability. Magnetic flux density is to be kept well below the saturation point. Core construction shall include mitered joints to keep core losses, excitation current and noise level at a minimum.

.3 The main transformer tank and any attached compartment or piping shall be designed to withstand pressures ranging from full vacuum to 15 PSI without deformation.

.4 The main tank cover shall meet or exceed C57.12.28. Cover to be welded or bolt-on

.5 The tank cover shall be designed to prevent the accumulation of oil and/or rainwater.

.6 A manhole shall be provided to allow access into the transformer interior. Manholes shall be a minimum of 600 mm (24”) diameter. Handholes shall be provided and sized to permit changeout of bushings.

.7 Lifting lugs and jacking facilities shall be provided to allow lifting or jacking of the transformer as follows:

.1 Lifting facilities for the whole transformer. The bearing surfaces of the lifting means shall be free of sharp edges.

.2 Lifting means for un-tanking the transformer.

.3 Jacking facilities shall be located near the extreme ends of the junction of the base segments.

.4 The jack ports or lugs shall be suitably sized and located to allow the insertion of the lifting members in accordance with ANSI C57.12.10.

.8 Cable termination enclosures shall be NEMA 4X type according to the Canadian Electrical Code. They shall be sized to bend power cables within the interior and maintain the required bending radius. Enclosure shall be designed to connect either cable or bus duct.

.9 Tank grounding provisions shall consist of two ground pads, welded on the base or on the tank wall near the base on diagonally opposite corners of the tank. Additional ground pades shall be furnished near each neutral bushing and surge arrester.

.10 The transformer shall be painted ANSI 61. Use a corrosion inhibiting primer and the Vendor's premium paint finish such as Acrycote or epoxy powder. The painting must be suitable for the specified ambient conditions and in particular must be oil , grease, acid and salt corrosion resistant.

.11 Provide two litres (liquid or aerosol spray) of finish touch up paint for field use.

2.5 TRANSFORMER LIQUID

.1 The transformer, including tap changers and oil filled compartments, shall be supplied with mineral oil meeting the requirements of ASTM-3487I suitable for -40 degree C operation.

2.6 BUSHINGS

.1 Surge Arrestor: n/a

.2 The insulation level of the line bushings including surge arrestors shall be no less than that specified for the winding terminal to which they are connected. Bushings type shall be the manufacturer's standard. Load break elbow style bushings are not acceptable.

.3 Neutral bushings shall be furnished for all three-phase wye-connected windings. Where a neutral ground resistor is specified, an external Xo bushing shall be provided. Where a neutral ground resistor is specified to be mounted on the top of the transformer tank, an external Xo bushing shall be provided on the top of the tank.

2.7 PRIMARY (INCOMING / LINE) AND SECONDARY (OUTGOING/LOAD) SECTION

.1 Where indicated on the drawings, the transformer shall have one integrally mounted air-filled primary terminal compartment with pothead, clamp-type terminals or compression type terminals. Refer to the drawings for specific wire size and type. The terminals shall be radial feed.

2.8 ACCESSORIES

.1 Line Drop Compensation: A line drop compensator is not required.

2.9 MISCELLANEOUS

.1 The transformer nameplate and all gauges shall be easily readable from grade.

.2 The transformer control cabinet and tap changer operating handle shall be accessible from grade and pad lockable.

2.10 FINISH

.1 The tank paint finish shall be neat clean and highly resistant to corrosion. Metal surfaces shall be thoroughly cleaned of all foreign matter prior to painting. Finish shall be ANSI 61 gray paint.

2.11 CONSERVATOR

.1 Not required but will be considered if included in shop drawing submission.

2.19 LIGHTNING ARRESTOR

.1 Not required.

2.20 HIGH VOLTAGE DISCONNECT

.1 Not required.

2.21 SPARE PARTS

.1 Provide and install the following loose shipped spare parts
- .1 5KV bushing x 1
- .2 600V Bushing x 1
- .3 Gasket Kit x 2
- .4 Radiator Valve x 2

2.12 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Label size: 7.

.3 Indicate equipment identifier, KVA rating, primary and secondary voltage.

Part 3 Execution

3.1 VENDOR TESTING

.1 The transformer shall be visually inspected to ensure that all specified components are present.

.2 Transformers shall be tested in accordance with the standard transformer test requirements of IEEE C57.12.90.

.3 The transformer tested values shall be within the standard tolerances given in standard IEEE C57.12.90.

3.2 SHIPMENT

.1 Impact recorders or pop-ups shall be provided for all transformers 5 MVA and larger.

.2 Transformers with sealed tank designs shall be filled with insulating liquid and shall include a positive dry nitrogen purge unless otherwise noted.

.3 The supplier shall notify the Contractor and Contract Administrator promptly of all shipments, giving all pertinent data for the tracing of the shipment and route to the destination.

.4 The names and addresses and addresses of all officials to whom such shipping memoranda are to be forwarded will be supplied after award of the Contract.

.5 Materials shall be prepared for shipment in such manner as to facilitate handling and to prevent damage during handling and in transit.

.6 Shipping crates shall be sealed against moisture ingress to prevent damage to the contents.

.7 Provide instructions on storage and protection well in advance of shipping. If any special instructions are necessary covering safe storage, give them to the Contractor responsible for installation of the equipment.

.8 The Contractor will sign the carrier's bill of lading to indicate receipt of the required number of crates, packages, etc., and will note thereon any apparent shortages of or visible damage to such crates, packages, etc. The supplier shall furnish to the City, lists showing the contents of the said crates, packages, etc., complete with all necessary handling and off-loading instructions. Such lists shall be furnished sufficiently early so that copies will be available at the site when delivery of the said equipment and appurtenances is made. Within seven days after the date of delivery to the site, the City will notify the Supplier in writing of shortages or damage in equipment delivered.

.9 The Contractor is responsible for unloading and placing the equipment in location or storage. The Contractor will be responsible for off-loading at site, for storing the equipment, appurtenances and materials and for protection against weather loss, damage, or theft. The supplier shall provide full instructions of all precautions to be observed in connection with the handling, storing and protection of the equipment.

.10 The Contractor is responsible for all temporary heating power supply connections necessary to ensure anti-condensate heaters are operational as required by manufacturers recommendations as soon as transformers are unloaded from the shipping trailer. Keep condensate out of transformers prior to the completion of installation.

.11 The Transformer, at the time of delivery, shall have, included with the shipment, the following items:

- Gaskets as required
- Touch-up paint
- Sufficient amount of top-up oil required to complete installation is to be advised – top-up oil is not to be supplied
- If the Transformer is gas filled for shipment, a non-toxic type of gas is preferred. When gas filled, a suitable pressure gauge shall be installed. The gauge reading shall be forwarded along with other shipping data.

3.3 OPERATION AND MAINTENANCE MANUALS

.1 Provide the following at minimum for inclusion in the project Operation and Maintenance Manuals:
- .1 Warranty page, including: date of warranty expiration, supplier contact information
- .2 All reviewed shop drawings, separated by dividers
- .3 Maintenance information for all equipment.
- .4 Product specification sheets
- .5 Test reports
- .6 Spare parts list

.2 Operation and Maintenance Manual to submitted to Contract Administrator for review Prior to delivery date.

3.4 TESTING

.1 Each transformer shall receive all standard commercial tests in accordance with ANSI C57.12.90, latest revision, with test results available by transformer serial number upon request.

.2 Complete ANSI design test data shall be available on the transformer, including short circuit testing, available on request.

3.5 EXAMINATION

.1 Verify that liquid-filled transformers are ready to install.

.2 Verify field measurements are as instructed by manufacturer.

.3 Verify that required utilities are available, in proper location and ready for use.

.4 Beginning of installation means installer accepts conditions.

3.6 INSTALLATION

.1 Install per manufacturer's instructions.

.2 Install required safety labels.

3.7 FIELD QUALITY CONTROL

.1 Field inspection (testing) shall be performed by trained qualified Transformer manufacturer technician.

.2 Test dielectric liquid to ASTM D877, using 25,000 volts minimum breakdown voltage, after installing transformer and before energizing it from system.

.3 Inspect installed transformers for anchoring, alignment, grounding and physical damage.

.4 Check tightness of all accessible mechanical and electrical connections with calibrated torque wrench. Minimum acceptable values are specified in manufacturer's instructions.

3.8 ADJUSTING

.1 Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and/or electrical operation as described in manufacturer's instructions.

.2 Adjust primary taps so that secondary voltage is within 2 percent of rated voltage.

3.9 CLEANING

.1 Clean interiors of enclosures to remove construction debris, dirt, shipping materials.

.2 Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.3 SUBMITTALS

.1 Submit product data in accordance with Contract Document including:

.1 Manufacturer's instructions,

.2 printed product literature.

.3 data sheets.

.4 product characteristics.

.5 performance criteria.

.6 physical size.

.7 Finish.

.8 limitations.

.2 Shop Drawings:

.1 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 For SPD units

.1 Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).

.2 For side-mount mounting applications (SPD mounted external to electrical

assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards and SPD for incorporation into manual.

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 and protect panelboards from nicks, scratches, and blemishes.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 PANELBOARDS, 240 V OR LESS (PNL-F73)

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 120/208 V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated on the drawings.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of equal ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel.

.11 Isolated ground bus.

.12 Include grounding busbar with minimum 3 terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21- Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top of panel. When mounted vertically, down position should open breaker.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Nameplate for each panelboard size 7 engraved as follows:

.1 Line 1 is to be the panel identifier on the drawings, for example "PNL-F73".

.2 Line 2 is to be the voltage, for example "120/208V, 3Ø".

.3 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.4 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

2.4 SURGE PROTECTIVE DEVICE (INSTALLED ON PNL-F73)

.1 Supply and install a Surge Protective Device (SPD) where shown on the drawings.

.2 Requirements:

.1 SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 5th Edition).

.2 Voltage: Refer to drawings.

.3 Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.

.4 The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.5 Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are:

.1 3Ø, 3W System: L-L, and L-G

.2 3Ø, 4W Wye System: L-L, L-N, L-G, and N-G

.3 1Ø, 3W Wye System: L-L, L-N, L-G, and N-G

.6 Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 80kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 80kA shall be rejected.

.7 Make: Service Track

.8 Model: TK-ST080-3Y208

.1 UL 1449 2nd Edition/UL 1449 3rd & 4th Edition Voltage Protection Ratings

.1 L-N, L-G, N-G:

- 400V/700V

.2 L-L:

- 800V/1000V

.2 Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

.3 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

.4 Electrical Noise Filter – Each unit shall include a high- performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB

.5 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall utilize low impedance conductors.

.6 Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

.1 Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of each protection mode on each phase.

.7 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

.1 Overcurrent Protection

.1 The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

.2 Panelboard Installation Requirements:

.1 The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and subfeed breaker options.

.2 The panelboard shall be capable of re-energizing upon removal of the SPD.

.3 Utilize a breaker, appropriately rated as directed by the SPD manufacturer, to connect the SPD to the panelboard. The SPD shall be located directly adjacent to the circuit breaker.

.4 Install SPD as shown on the drawings.

.1 Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Departmental Representative.

3.2 INSTALLATION

.1 Locate panelboards and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height of two (2) metres to top of cover, as required by Code.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

3.3 TESTING

.1 Test in accordance with Section 26 08 05.

3.4 CLEANING

.1 Progress Cleaning:

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

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

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Electrical Equipment Manufacturers Association of Canada (EEMAC)

1.2 COORDINATION

.1 Coordinate installation with:

.1 Section 409513 - Automation - Control Panels
.2 Section 261217 - Transformers
.3 Section 262910 - Motor Starters
.4 Section 262923 - Variable Frequency Drives

.2 Mechanical Equipment Controls to provide a complete integrated functional system.

1.3 SUBMITTALS

.1 Submit product data in accordance with Contract Document including:

.1 manufacturer's instructions,

.2 printed product literature,

.3 data sheets,

.4 performance criteria,

.5 physical size,

.6 Finish,

.7 limitations.

.2 Submit shop drawings in accordance with contract documents, stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.3 Submit full technical data, service and parts facilities complete with manufacturer's publish data.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for motor control centre for incorporation into manual.

.1 Include data for each type and style of starter.

1.5 EXTRA STOCK MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00- Closeout Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

.1 MCC unit to be procured by the City and delivered to site by the manufacturer. Contractor is responsible for offloading and transportation on site.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect motor control centres from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

.1 600 VAC, 60 Hz, Wye connected, 3 Phase, 4 Wire.

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor CSA gasketed enclosure.

.4 Suitability for Service Entrance: Yes.

.5 Maximum width as shown on drawings.

.6 Wiring class: Class 1, Type B-D or B-T as shown on the drawings.

.7 Compartment Nameplates:

.1 White background with black letters.

.2 Identification as indicated on the Drawings.

.8 Nameplates for Control Equipment Flush Mounted on Compartments:

.1 White background with black letters. Black background with white text will not be accepted.

.2 Identification as indicated on the Drawings.

.3 Locations as shown on the Drawings

.9 SCCR: 25 kA minimum.

.10 Acceptable manufacturer:

.1 Schneider Electric Model 6.

.2 This product is standardized by the City via RFP 756-2013. No alternates or substitutes will be accepted.

.11 Purchase or Quotation:

.1 MCC has been purchased prior to this Bid Opportunity 479-2024. Delivery expected January 2025.

2.3 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, height as indicated.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Incoming cables to enter at top.

.8 Provision for outgoing cables to exit via top or bottom with terminals.

.9 Removable lifting means.

.10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.11 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

.12 Provide all spaces complete with bussing hardware and other accessories required so that additional combination starter units can be readily installed. Provide barriers to isolate the space from all buswork.

.13 Provide barriers to isolate all buswork to prevent accidental contact when starter units are removed or spaces are provided. Barriers shall also provide phase-to-phase isolation of the vertical bus.

.14 Master nameplate lamacoid: text as follows:

.1 Line 1 is to be MCC identifier as indicated on the Drawings, for example

.2 "MCC-F71".

.3 Line 2 is to be the voltage, for example "600V, 3-Phase".

.4 Line 3 is to be the rating, for example "1200A, 4-Wire".

2.4 SILLS

.1 Continuous channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

.1 Main horizontal and branch vertical, three phase high conductivity plated aluminum busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: as indicated.

.2 Branch vertical busbars: as indicated.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current of 42kA rms symmetrical.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 EQUIPMENT GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

.1 Size: 6 x 25 mm (1/4" x 1")

.2 Plating: Tin

.3 Location: Top

.2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

.1 Material: tin plated copper.

2.7 SURGE PROTECTION DEVICE (XS-F712)

.1 The terms Surge Protection Device (SPD) and Transient Voltage Surge Suppressor (TVSS) shall mean the same device and be interchangeable throughout the contract documents.

.2 MCC supplier to supply and install a Surge Protection Device (SPD)/Transient Voltage Surge Suppressor (TVSS) where shown on the drawings. Contractor to verify and complete wiring as needed.

.3 Requirements:

.1 SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

.2 Voltage: Refer to drawings.

.4 Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.

.5 The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.6 Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are:

.1 3Ø, 3W System: L-F, and L-G

.2 3Ø, 4W Wye System: L-F, L-N, L-G, and N-G

.3 1Ø, 3W Wye System: L-F, L-N, L-G, and N-G

.7 Nominal Discharge Current (In) – All TVSSs applied to the distribution system shall have a 20kA In rating regardless of their TVSS Type (includes Types 1 and 2) or operating voltage. TVSSs having an In less than 20kA shall be rejected.

.8 ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

.1 L-N, L-G, N-G:

.1 120/208 V: 700V

.2 347/600 V: 1500V

.2 L-F:

.1 120/208 V: 1200V

.2 347/600 V: 3000V

2.8 SPD Design

.1 Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

.2 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

.3 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method.

.4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall utilize low impedance conductors.

.5 Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

.1 Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of each protection mode on each phase.

.6 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

.7 Overcurrent Protection

.1 The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV

in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

.8 Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following:

.1 600V Equipment – Service Entrance: 240 kA

.2 600V Equipment – Not Service Entrance: 120 kA

.9 Installation Requirements:

.1 The SPD shall be installed immediately following the load side of the main breaker or main switch.

.2 The MCC shall be capable of re-energizing upon removal of the SPD.

.3 Utilize a breaker, appropriately rated as directed by the SPD manufacturer, to connect the SPD to the MCC. The SPD shall be located directly adjacent to the circuit breaker.

.4 The SPD shall be included and mounted within the MCC by the manufacturer of the MCC where shown on the drawings.

.1 The complete MCC including the SPD shall be CSA/cUL listed.

2.9 POWER METER (MCC-F71.PM)

.1 Where indicated on the drawings, provide a microprocessor based multifunction power meter.

.2 Requirements:

.1 Multifunction electrical measurement on 3 phase power systems.

.2 User programmable for voltage range to any PT ratio.

.3 Integrated display.

.4 Accept a direct voltage input range of up to 347 Volts Line to Neutral, and a range of up to 600 Volts Line to Line.

.5 Accept a current input of up to 5 Amps nominal, 10 Amps full scale.

.6 Programmable for current to any CT ratio. The use of DIP switches for selecting

.7 fixed ratios shall not be acceptable.

.8 Maximum burden of 0.0625 VA at 10 Amps.

.9 The meter shall have an accuracy of +/- 0.25% or better for volts and amps, and

1.5% for power and energy functions.

.10 The meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.

.11 Function Requirements:

.1 Volts, Amps, kW, kVAR, PF, kVA (per phase)

.2 Frequency, kWh, kVAh, kVARh

.3 Harmonics measurement, individual, even, and odd, up to 15th.

.12 Operating Temperature:

.1 -20°C to +60°C ambient.

.3 Communications ports:

.1 RS-485 supporting Modbus/RTU.

.2 10 Mbps or 10/100 Mbps Ethernet supporting Modbus/TCP.

.4 Acceptable Products:

.1 Schneider Electric PM8000 series.

.2 Or approved equal in accordance with B7.

2.10 VOLTAGE MONITORING RELAY, ESL-F711

.1 Requirements,

.1 Suitable for direct connection to MCC bus having nominal operating voltage of 600 V line-to-Fine.

.2 Adjustable nominal input voltage via potentiometer from 500 V to 600V.

.3 Undervoltage trip point:

.1 Adjustable from 88% to 92% of nominal voltage.

.2 Voltage unbalance:

.1 Adjustable from 2% to 10%.

.3 Phase loss detection:

.1 Triggered upon ≥ 15% unbalance.

.2 Response time ≤ 200 msec.

.4 Trip delay:

.1 Adjustable from 1 to 30 sec.

.5 Automatic reset (restart) delay:

.1 Adjustable from 0.6 to 64 sec.

.2 Adjustable random restart delay from 3 to 15 sec.

.6 Faults stored in non-volatile memory.

.1 Storage of the last 10 faults.

.7 Status and faults displayed on LED readout.

.8 Remote reset input.

.9 CSA approved.

.4 Relay output:

.1 Equipped with, at minimum, one Form C electromechanical dry contact output for monitoring.

.2 Relay contact to be normally open, held-closed during normal operation, and open upon an alarm condition.

.3 Actuate relay on any of the following:

.1 Phase A-B, B-C, or C-A voltage less than 575 V.

.2 Voltage unbalance greater than 10%.

.4 Rated at 10A resistive @ 250 VAC, 6A inductive (0.4 PF) @ 250 VAC.

.5 Mechanical life of 1x107 operations.

.5 Acceptable products:

.1 Littlefuse DLMHBRAAA.

.2 Or approved equal in accordance with B7.

2.11 PROCESS METERS (VIC-F010-1, VIC-F010-2, VIC-F020-1, VIC-F020-2, VIC-F030-1, VIC-F030-2)

.1 Display digital reading of process value and provide control of output relays based on input.

.2 Display:

.1 Dual-Fine 6-digit

.2 Type: Alpha-numeric, LED.

.3 Update rate: 5/second (200 ms) minimum.

.4 Character colour: red.

.3 Features:

.1 Internal 24V dc loop power supply for providing loop power to external devices.

.4 Analog Inputs:

.1 0-20 mA, 4-20 mA, +/- 10V, 0-5V, 1-5V field selectable.

.2 Input impedance:

.1 Voltage ranges: > 500k Ω.
.2 Current ranges: 50 - 100 Ω.

.5 Discrete Inputs:

.1 Allows for external interlock of output relays

.6 Output relays:

.1 Qty 4, Form C, unless otherwise noted.

.2 Electrical rating: 3 Amps at 30 VDC and 125/250 VAC resistive.

.7 Analog Outputs:

.1 Isolated 4-20 mA

.2 Settable to input process variable

.8 Mounting: panel mount, 1/8 DIN (92 mm x 45 mm) cutout.

.9 Power supply: 85-265 VAC.

.10 Manufacturer and model:

.1 Precision Digital PD6000-6H7

.2 Or approved equal in accordance with B7.

2.12 MOTOR STARTERS AND DEVICES

.1 Equip the MCC with combination starters, soft starters, and VFDs as specified and shown on the drawings.

.2 Refer to Section 26 29 10 – Motor Starters to 600 V.

2.13 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 200A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free-floating tin-plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front.

.7 Devices and components by one manufacturer to facilitate maintenance.

.8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

.9 Control wiring shall be extended from each starter module to the control terminal section, including all auxiliary contacts. A multi unit style terminal block having screw type terminal connections shall be installed on standoff supports on back plate.

.10 All terminals shall be number coded or otherwise suitably identified to indicate which section or module of the MCC they are associated with and their function.

.11 Complete control wiring diagrams for each starter with conductor identification clearly shown shall be affixed to the interior cover of the starter section or provide a book of wiring diagrams for all starters in each MCC.

.12 Primary and secondary high rupturing capacity (HRC) fusing shall be installed on the control transformer.

.13 Equip door of each individual unit with a removable plate replaceable with similar plate complete with pushbuttons, pilot lights or selector switches as required. Use pilot lights of push-to-test type and push button of heavy-duty oil tight construction.

2.14 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 01- Common Work Results for Electrical.

2.15 EQUIPMENT IDENTIFICATION

.1 Identify Motor Control Centre with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic lamacoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

.3 Nameplate sizes:

.1 Motor control centre main nameplate 70 x 120 mm 1 line 40 mm high letters

.2 Individual compartment nameplates 30 x 90 mm 3 lines 5 mm high letters

.3 Compartment Device nameplates 30 x 25 mm 2 lines 3 mm high letters

.4 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate.

.6 Identification to be English.

2.16 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 exterior light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Paint interior white, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.17 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

2.18 SPARE PARTS

.1 One (1) set of fuses of each type and size.

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 motor control centres 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 INSTALLATION

.1 Provide housekeeping pad below the MCC lineups as per the drawings.

.2 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.3 Make field power and control connections as indicated.

.4 Ensure correct overload heater elements are installed.

.5 Coordinate concrete pad with bevelled edges as shown on the Drawings, sized to suit MCCs, install and level channel sills and mount MCCs.

3.3 TESTING

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results – For Electrical.

.2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

.3 Provide separate completed test forms for each MCC starter section.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hours period.

3.5 CLEANING

.1 Progress Cleaning:

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

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

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

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by installation.

END OF SECTION

Part 1 General

1.1 COORDINATION

.1 Coordinate size and depth of cabinets and enclosures with systems specified in other Sections which require enclosures.

.2 Coordinate installation and identification of cabinets and enclosures with painting of mechanical and electrical work specified in Division 09.

1.2 SHOP DRAWING AND PRODUCT DATA

.1 Indicate detail construction, dimension, capacities, weights and electrical performance characteristics of equipment or material.

2. Products

2.1 CABINETS AND ENCLOSURES - GENERAL

.1 Cabinets and Enclosures: to CSA C22.2 No. 40-M1989 and as follows:

.1 NEMA 3R rated enclosure for all outdoor locations except within hazardous areas.

.2 NEMA 12 rated enclosures for devices within electrical rooms or control rooms unless otherwise specified.

.3 NEMA 4X rated enclosure for all other locations except within electrical rooms and control rooms unless otherwise specified.

.4 NEMA 7 rated enclosure for all hazardous rated locations.

.4 Door: hinged, minimum 3 point latching, with padlocking means.

.5 Door interlocks

3. Execution

3.1 INSTALLATION

.1 Install surface or flush mounted cabinets at locations and heights indicated on drawings.

.2 Assemble enclosure in accordance with manufacturer's instructions.

.3 Mount equipment in enclosure.

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.42-10 (R2015), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-13 (R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-15, Special Use Switches.

.4 CSA-C22.2 No.111-18, General-Use Snap Switches (Trinational standard with UL 20 and NMX-J-005-ANCE)

1.3 COORDINATION

.1 Coordinate installation of wiring devices and cover plates with site painting and finishing work specified in Division 09.

1.4 SHOP DRAWING AND PRODUCT DATA

.1 Provide manufacturer's literature including applicable reference standards, performance and test data for following products:

.1 All switches.
.2 All receptacles.
.3 All plates.
.4 All dimmers.
.5 All photocells.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111 as required.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Fully enclosed with urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.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 Acceptable materials: Leviton specification grade, Hubbell specification grade

2.1 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Ivory or brown urea moulded housing;

.2 Suitable for No. 10 AWG for back and side wiring;

.3 Break-off links for use as split receptacles;

.4 Eight (8) back wired entrances, four (4) side wiring screws; and

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Brown urea moulded housing;

.2 Suitable for No. 10 AWG for back and side wiring; and

.3 Four (4) back wired entrances, 2-side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout Project.

.5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.1 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Stainless steel or PVC cover plates for wiring devices.

.3 Cover plates from one manufacturer throughout Project.

.4 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.5 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.6 Weatherproof double lift spring-loaded stainless steel or PVC cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded stainless steel or PVC cover plates complete with gaskets for single receptacles or switches.

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 receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount lighting fixture receptacles local to fixtures.

.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: F73-2 (Panel F73, circuit 2)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers and circuit breakers.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489 and NMX-J-266-ANCE-2016).

1.3 SUBMITTALS

.1 Submit product data in accordance with Contract Document.

.2 Include time-current characteristic curves for breakers with ampacity of ninety (90) A and over or with interrupting capacity of twenty-two thousand (22,000) A symmetrical (rms) and over at system voltage

.3 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 2 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Departmental Representative for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and Circuit breakers to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for forty (40) degrees Celsius ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from three (3) to eight (8) times current rating.

.5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating matching panel board or switchboard containing breaker.

.6 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.7 Include:

.1 On-off locking device.

.2 Neutral and Ground bus bars, fully rated.

2.2 CDP-F70.MCB-F70 (CDP-F70 MAIN BREAKER)

.1 Requirements:

.1 Frame Size: 1200 Amps

.2 Sensor Rating: 1200 Amps

.3 Interrupting Rating: 25 kA @ 600 VAC minimum

.4 Trip Unit Type: Electronic LSIG, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Long Time Delay: 0.5 – 24 sec (Adjustable)

.7 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.8 Short Time Delay: 0.0 to 0.4 sec (Adjustable)

.9 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.10 Ground Fault PU: 0.2 to 1.0 (A to I) * Sensor Rating (Adjustable)

.11 Ground Fault Delay: .1 to .4 sec (Adjustable)

.12 Poles: 3

.13 Model: Schneider Electric PowerPact P series with Micrologic 6.0A series trip unit or approved equal in accordance with B7.

2.3 CDP-F70.CB-L70 (CDP-F70 LIFT STATION BREAKER)

.1 Requirements:

.1 Frame Size: 400 Amps

.2 Sensor Rating: 400 Amps

.3 Interrupting Rating: 25 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSI, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Long Time Delay: 0.5 – 24 sec (Adjustable)

.7 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.8 Short Time Delay: 0.0 to 0.4 sec (Adjustable)

.9 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.10 Poles: 3

.11 Model: Schneider Electric PowerPact L series with Micrologic 3.3S series trip unit or approved equal in accordance with B7.

2.4 MCC-F71.MCB-F71 (MCC MAIN BREAKER)

.1 Requirements:

.1 Frame Size: 1200 Amps

.2 Sensor Rating: 1000 Amps

.3 Interrupting Rating: 25 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSIG, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Long Time Delay: 0.5 – 24 sec (Adjustable)

.7 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.8 Short Time Delay: 0.0 to 0.4 sec (Adjustable)

.9 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.10 Ground Fault PU: 0.2 to 1.0 (A to I) * Sensor Rating (Adjustable)

.11 Ground Fault Delay: .1 to .4 sec (Adjustable)

.12 Poles: 3

.13 Model: Schneider Electric PowerPact P series with Micrologic 6.0 A (Ammeter) series trip unit or approved equal in accordance with B7.

2.5 MCC-F71.CB-F01 (PUMP 1 BREAKER)

.1 Requirements:

.1 Frame Size: 400 Amps

.2 Sensor Rating: 400 Amps

.3 Interrupting Rating: 25 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSI, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.7 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.8 Poles: 3

.9 Model: Schneider Electric PowerPact L series with Micrologic 3.3S series trip unit or approved equal in accordance with B7.

2.6 MCC-F71.CB-F02, MCC-F71.CB-F03 (PUMP 2 AND 3 BREAKERS)

.1 Requirements:

.1 Frame Size: 600 Amps

.2 Sensor Rating: 600 Amps

.3 Interrupting Rating: 25 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSI, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.7 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.8 Poles: 3

.9 Model: Schneider Electric PowerPact L series with Micrologic 3.3S series trip unit or approved equal in accordance with B7.

2.7 THERMAL MAGNETIC BREAKERS < 100A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 Requirements:

.1 Trip Rating: As shown on the drawings.

.2 Interrupting Rating: 25 kA @ 600 VAC

.3 Type: Thermal Magnetic

.4 Poles: As shown on the drawings.

.5 Model: Schneider Electric PowerPact H series or approved equal in accordance with B7.

2.8 OPTIONAL FEATURES

.1 As indicated

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 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. Example: “XFMR-F73”.

.3 Set adjustable trip settings according to coordination study.

3.2 CLEANING

.1 Progress Cleaning:

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

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

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-M89 (R2000), Enclosed Switches; and

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies

1.3 SUBMITTALS

.1 Submittals in accordance with contract documents.

.2 Indicate:

.1 Mounting method and dimensions.

.2 Enclosure types.

Part 2 Products

2.2 DISCONNECT SWITCHES (DS-F01, DS-F02, DS-F03).

.1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 Auxiliary contact for switch status.

.6 ON-OFF switch position indication on switch enclosure cover.

.7 Category 1 locations: NEMA 4.

.8 Category 2 locations: NEMA 4x.

.9 Ordinary locations: NEMA 12.

.10 Acceptable Manufacturer: Square D, Eaton, Hubbell, Pass & Seymour, Leviton

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 PROCEDURES

.1 Install disconnect switches as indicated and in accordance with the manufacturer's recommendations and as required by CSA C22.1.

.2 Mount securely such that top of switch is a maximum of 1600 mm (63") above finished floor. Provide a minimum of 1000 mm (39") clear floor space in front of the switch.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 CSA International

.1 CSA C22.2 No.14-18, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Contract Document.

.2 Extra Materials:

.1 Submit manufacturer's instructions, printed product literature and data sheets for contactors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Provide closeout submittals in accordance with Contract Document.

.2 Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect contactors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONTACTORS

.1 UL/CSA listed, NEMA size as shown on the drawings.

.2 Contactors: to CSA C22.2 No.14.

.3 Electrically held and controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in NEMA 4 Enclosure

.6 Include following options in cover:

.1 Red or Green indicating lamp, as indicated.

.2 Stop-Start pushbutton, as indicated.

.3 Hand-Off-Auto selector switch, as indicated.

.4 On-Off selector switch, as indicated.

.7 Control transformer: in accordance with Section 26 29 03- Control Devices, factory wired and installed in contactor enclosure.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Size 4 nameplate as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install contactors and connect power wires and auxiliary control devices.

.2 Identify contactors with nameplates or labels indicating panel and circuit number.

3.2 CLEANING

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

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

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

3.3 PROTECTION

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

.5 Repair damage to adjacent materials caused by contactor installation.

3.4 FIELD QUALITY CONTROL

.6 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical and manufacturer's instructions.

.7 Operate switches and contactors to verify correct functioning.

.8 Perform starting and stopping sequences of contactors and relays.

.9 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.14-10 , Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000(R2008), Industrial Control and Systems: General Requirements.

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 control devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.2 Include schematic, wiring, interconnection diagrams.

1.3 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 01 - Common Work Results for Electrical.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for control devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect control devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14.

.2 Fixed contact plug-in type: general purpose heavy duty with two poles. Coil rating: 120V. Contact rating: 240V, 2A

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open – convertible to normally-closed in field.

2.3 PUSHBUTTONS

.1 Operator mushroom type, Black, with 2-NO and 2-NC contacts rated at 10A, AC/DC, labels as indicated. Stop pushbuttons coloured red. Start pushbuttons coloured green.

2.4 EMERGENCY STOP PUSHBUTTONS

.1 Operator mushroom type, 2-position, Push-Pull operator, Red, with 1-NO and 1-NC contacts rated at 10A, AC/DC, labels as indicated.

2.5 SELECTOR SWITCHES

.1 Maintained three (3) position labelled as indicated. heavy duty, thirty 30 mm, oil tight, operators wing lever contact arrangement as indicated, rated 120V, 10A, AC.

2.6 INDICATING LIGHTS

.1 Standard, full voltage, LED type, lens colour: as indicated, supply voltage: as indicated, lamp voltage: as indicated, labels as indicated.

2.7 CONTROL AND RELAY PANELS

.1 CSA Type 12 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.8 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 600V, 60 Hz ac.

.3 Secondary: 120V, AC.

.4 Rating: 150 VA, or larger as required.

.5 Secondary fuse: ampacity as required.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.9 IDENTIFICATION

.1 All control devices shall be labelled exactly as shown in the Drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for control devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Contract Administrator.

.2 Inform the 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 the Contract Administrator.

3.2 INSTALLATION

.1 Contractor is responsible for installation, wiring, testing, and assisting the Contract Administrator in commissioning of all HMI equipment, HMI communication equipment, PC equipment and Operator interfaces.

.2 The Contractor shall supply and deliver to the Contract Administrator any HMI or PLC products identified herein for the purpose of programming. The Contract Administrator will advise the contractor when and which items will be required on a later date. The Contractor will pay all costs associated with handling, extended warranties, etc.

.3 Contractor shall supply all required cabling to connect hardware above.

3.3 INSTALLATION

.1 Install pushbutton stations, control and relay panels, and control devices.

.2 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

3.4 CLEANING

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

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

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 MCC and associated starters have been pre-procured as part of this project. Contractor scope does not include supply portions of this specification.

1.2 REFERENCES

.1 National Electrical Manufacturer's Association (NEMA)

.1 NEMA Standards Publication ICS 2-2000: Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Contract Document.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide shop drawings: in accordance with Contract Document.

.1 Provide shop drawings for each type of starter to indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure type.

.5 Wiring diagrams for each type of starter.

.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Contract Document.

.2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

.3 Extra Materials:

.1 Provide listed spare parts for each different size and type of starter.

.1 3 contacts, stationary.

.2 3 contacts, movable.

.3 1 contacts, auxiliary.

.4 1 control transformer.

.5 1 operating coil.

.6 2 fuses.

.7 10% indicating lamp bulbs used.

Part 2 Products

2.1 SOFT STARTERS

.1 Each soft starter is to be an integral modular combination soft starter with integral bypass sized for the rated voltage, current and torque requirement of the driven load.

.2 Each soft starter to house the following features:

.1 The starter shall be enclosed in the motor control center unless otherwise specified on the drawings. Hinged, front access doors shall be provided.

.2 Starter to include a remote mount soft starter interface module mounted in the front face of the existing MCC door. Interface module to be complete with LCD display and entry keypad.

.3 The starter shall be complete with cable compartments for connection of incoming and outgoing cables.

.4 When auxiliary cooling is required, the starter shall have fan(s) and thermostatic controls for proper operation. Fans are to be installed in the existing MCC door.

.5 Terminal blocks for control, alarms, metering and diagnostics shall each be readily accessible, grouped and shall be segregated from power devices, for personnel safety.

.6 The starter shall provide the following relay outputs (form C, rated 2 amp at 120 VAC) as minimum:

.1 Run Status

.2 Alarm
.3 Up to speed

.7 The starter enclosure shall house integral overcurrent protection by means of a molded case air circuit breaker style complete with rotary type switch with operating handle and lock-off facility. Opening starter enclosure restricted by the use of a defeater screw, unless switch is in the "Off" position.

.8 Bypass feature shall disconnect soft starting circuit when not required for acceleration or deceleration of the load.

.9 Analog 4-20mA current output to provide scaled motor current feedback to PLC via a current transmitter located in the soft starter bucket.

.3 Each soft starter will conform to the following front panel construction requirements

.1 Install the following features as a minimum on the Soft Starter door:

.1 HOA selector switch

.2 Elapsed time meter

.3 LED pilot lights as indicated on the drawings

.4 Digital Soft Starter Display

.5 Rest button for pump reset

.2 All the devices indicated are to be industrial type, 35mm diameter.

.3 All front panel control and pilot devices to be clearly marked as to operation with 3mm thick, black face, white core, mechanically attached lamacoid nameplates with 8mm high letters.

.4 Soft Starters shall be by Schneider Electric complete with the aforementioned options. No alternates considered.

.5 Refer to drawings for horsepower, and supply voltage and control wiring requirements of soft starters.

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.

.2 IEC rated starters are not acceptable.

.2 Short Circuit Current Rating (SCCR):

.1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed 25 kA.

.3 Magnetic of size, type, rating and enclosure type as indicated with components as follows:

.1 All coils to be epoxy coated.

.2 Contactor solenoid operated, rapid action type.

.3 Motor overload protective device in each phase, manually reset from outside enclosure.

.4 Wiring and schematic diagram inside starter enclosure in visible location.

.5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.6 Transient suppressors shall be supplied for all coils in each individual starter unit.

.7 Mechanical and electrically interlock to defeat simultaneous starting the 2 contactors for reversing starters.

.4 Combination type starters to include motor circuit interrupter.

.5 Accessories:

.1 Selector switches and Pushbuttons: heavy-duty oil tight labelled as indicated.

.2 Indicating LED lights: heavy-duty oil tight type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contact unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 100VA minimum single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with primary and secondary fuses, installed in with starter.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses and overload device elements are installed.

.4 Confirm motor nameplate and adjust / replace overload device to suit.

3.2 MOTOR STARTER TESTING

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results – For Electrical.

.2 Perform complete testing of motor starter operation, including but not limited to:

.1 Simulating a fault to ensure the starter can be reset and put back into operation.

.2 Manual startup and shutdown.

.3 Automatic startup and shutdown.

.3 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full. Submit test results to the Contract Administrator.

.4 Contract Administrator and/or City of Winnipeg will be required to witness motor starter testing in person. Provide a minimum of two (2) weeks notice prior to performing testing of motor starters.

.5 Provide separate completed test forms for each MCC starter.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

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 SCOPE

.2 Division 26 Contractor shall install, wire and connect, and program all VFD controllers and indicated on the Drawings and provided settings letters. MCC and associated starters have been pre-procured as part of this project.

1.3 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.

1.4 STANDARD MOTOR

.1 All VFDs supplied under this Contract shall meet or exceed the following Specifications.

.2 Provide a complete inventory (as specified) of spare cooling fans, and fuses, for each VFD supplied.

.3 The adjustable frequency controller shall be designed to operate standard squirrel cage induction motor with a 1.15 S.F. or definite purpose motors meeting National Electric Manufacturers Association (NEMA) MG1 Part 31.

.4 Harmonic loading will not exceed a motor service factor of one (1.0).

.5 Products shall comply with Institute of Electrical and Electrical Engineers (IEEE) Standard 519.

.6 VFD unit shall be Underwriters Laboratories (UL) listed and Canadian Standards Association (CSA) certified.

.7 VFD unit shall comply with applicable requirements of the latest standards of CSA, American National Standards Institute (ANSI), IEEE and the Canadian Electrical

Code.

1.5 DESIGN REQUIREMENTS

.1 Provide equipment layout drawing detailing:

.1 The dimensions, physical arrangement of major components, and the degree of compartmentalization and physical segregation provided between components.

.2 Front layout of the panel

.3 Programming manuals for the equipment used

.4 When air-cooled systems are provided, the following shall also be shown:

.1 air inlet and outlet passages
.2 cooling fans
.3 filters.

1.6 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.

1.7 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Include operation and maintenance data for each type and style of VFD.

.3 Provide parameter settings for each VFD.

1.8 TESTS

.1 Factory testing:

.1 VFD units are to be factory tested prior to shipment. Provide confirmation from factory of actual tests completed and results.

.2 Provide certified copies of production test results required by CSA and Electrical and Electronic Manufacturer's Association of Canada (EEMAC), prior to acceptance of the equipment.

.2 Field testing:

.1 The VFD supplier shall provide on-Site start-up, fine-tuning, commissioning, operator training and instruction.

.2 The VFD supplier shall provide Site functionality test reports indicating loading/current levels during testing as well as control point proving results.

.3 The VFD supplier shall ensure shaft to ground voltages do not exceed 1.5 V at any speed or load requirement.

.4 Allow for all costs and labour for as many trips as necessary to complete requirements.

.5 It is the intent of this Specification to provide a VFD installation that does not adversely affect the electrical system. Included in the Contract Documents is information on the electrical system including:

.1 Single line Drawing.

.2 Additional information on electrical system layout and load profile.

.3 The VFD supplier can use this information to evaluate the predicted effect of the VFD installation on the electrical system and advise the Contract Administrator of these effects. For the purposes of analysis, the point of common coupling (PCC) will be taken as the secondary of the main distribution transformers.

.1 Provide certified copies of all production test results required by CSA and NEMA.

.2 Provide and complete the City of Winnipeg standard VFD test form.

1.9 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 Three (3) contacts, stationary.

.2 Three (3) contacts, movable.

.3 One (1) contacts, auxiliary.

.4 One (1) control transformers.

.5 One (1) operating coil.

.6 Two (2) fuses.

.7 Ten percent (10%) indicating lamp bulbs used

1.10 PARTS AVAILABILITY

.1 Guarantee that parts for the drive units be available for a minimum of ten years from time of delivery.

1.11 DESIGN REQUIREMENTS

.1 Ventilation system designed for ambient temperature range of 10°C to 35°C. temperature not to exceed 45°C.

Part 2 Products

2.2 VARIABLE FREQUENCY DRIVES (VFD-F67)

.1 MCC and enclosed starter supply is not included in this contract. Division 26 Contractor shall install, wire and connect, program, and commission all VFD controllers and indicated on the Drawings and settings letters.

.2 Variable Frequency Drives supplied by Schneider Electric: Altivar 630 series.

.1 Purchasing and/or quotes shall reference the City of Winnipeg RFP 756-2013 for the City of Winnipeg discount pricing.

.2 No alternates or substitutes will be accepted.

.3 Contact: Schneider Electric, 21 Omands Creek Blvd, Winnipeg, MB.

.4 The Bidder’s bid price shall reflect the discounted equipment price. The City will review the purchase price for standardized equipment to ensure the applicable discount factor has been applied.

.3 Variable speed controller shall be electronic adjustable frequency and voltage output unit.

.4 The VFD shall employ a minimum 6-pulse pulse width modulated (PWM) inverter system utilizing Insulated Gate Bipolar Transistors (IGBT) power switching devices and come complete with line reactors.

.5 Be capable of re-accelerating the driven equipment, following voltage dips greater than 20% of the rated input power supply, of up to 5 seconds duration, without the need to come to a complete stop. Vendor shall indicate the maximum time delay before re-acceleration begins following restoration of the supply voltage.

.6 Be capable to continue operation without coming to a standstill or resulting in process shutdown, 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 second.

.7 The drive shall be rated for continuous duty while operating a NEMA design induction motor of the sizes and operating voltages as indicated on the Drawings over the entire speed range. Drive output shall be sized for a one (1.0) motor service factor. The VFD shall have a current rating at least ten percent (10%) in excess of the motor full load amp rating. Overload service factors of one hundred ten percent (110%) for thirty (30) minutes and one hundred thirty-five percent (135%) for one (1) minute must be provided to ensure adequate safety margins. VFD selection shall be based on load current at constant torque ratings. Do not size VFD's based on variable torque maximums.

.8 Input voltage shall be as indicated on motor schedules and Drawings (line voltage variation plus or minus ten percent (±10%)) based on 347/600 volt systems (Not five hundred seventy-five (575) V). Line frequency variation plus or minus five percent (±5%). Output voltage shall vary with motor speed to nominal motor voltage. Speed stability shall be plus or minus one percent (±1%) of any given set point within the operating frequency range. Drive shall match torque characteristic of load.

.9 Input frequency setting signal will be selective between 4-20 mA or 0-10 v DC. Output speed monitoring signal shall be selective between 4-20 mA or 0-10 v DC.

.10 The VFD shall be provided with radio interference suppression and limit radio interference values to within the limits of local code requirements.

.11 VFD Input Run Command signal will be a 24Vdc discrete signal. Provide a 24Vdc relay in the VFD control compartment.

.12 Enclosure:

.1 Drive shall be installed in the MCC as indicated on Drawings. Filters to be provided for any forced air-cooled enclosures as required by the supplier. VFD(s) shall be suitable for mounting in a typical building electrical room and shall be able to operate under these conditions with no special cleaning requirements. VFD cabinets shall be mounted in such a way that there is adequate room for ventilation and no buildup of heat.

.2 VFD to be mounted in a way to ensure space is available for the installation of the bypass ATL starters within the MCC sections as indicated on the drawings.

.13 Protective devices to be incorporated are:

.1 Fast acting electronic circuit board protective devices for protection of electronic components.

.2 Three percent (3%) Line reactor.

.3 Drive output filter.

.4 Integral electronic motor overload protection adjustable up to one hundred fifty percent (150%) of motor rating for sixty (60) seconds.

.5 Overcurrent instantaneous trip two hundred fifty percent (250%).

.6 Programmable short-circuit protection.

.7 Programmable ground fault protection.

.8 Overvoltage/overcurrent DC bus monitor/protection.

.9 Undervoltage protection.

.10 Loss of phase and phase unbalance protection.

.11 Inverter over-temperature protection.

.12 Capable of running without motor for start-up.

.13 Maximum acceptable noise level is eighty (80) dBA at one (1) m.

.14 Operation features:

.1 Integral flush mounted display in VFD cover with keypad for programming, monitoring and operating of drive, accessible through password or other acceptable security measure only. Remote keypads, completely duplicating functions of integral keypads, shall also be provided for all VFD(s) that are not normally accessible such as located inside MCCs, fan plenums, etc. The remote keypads in these cases shall be located on the MCC section door.

.2 Fault shutdown and indication.

.3 Automatic restart following power outage.

.4 Ability to disconnect motor load for setup or trouble.

.5 Manual speed control potentiometer mounted on MCC door.

.6 Adjustable maximum and minimum speed.

.7 Acceleration and deceleration time adjustment.

.8 Controller “stop” interlock from a NC dry contact.

.9 Drive fault contact.

.10 Stop/start forward/start reverse push buttons on keypad and MCC door as indicated on the drawings.

.11 Transient voltage protection.

.12 Provide three (3) dry “C” type contacts programmable for any combination of the following:

.1 Running (output frequency being generated).

.2 Pump ready signals.

.3 High vibration lockout.

.4 Fault lockout.

.5 Stopped.

.6 At speed.

.7 Under speed.

.8 Forward/Reverse.

.9 Low reference.

.10 Manual/Auto Mode.

.11 Local/Remote Mode.

.13 Soft start sequence.

.14 Minimum of three (3) skip frequencies.

.15 Indicating lights as follows:

.1 Running (Red)

.2 VFD Fault (Orange)

.16 Provide Hand/Off/Auto selector switch. Keypad HOA is not an acceptable replacement.

.17 Password protection of parameter programming or some method to prevent unauthorized changes.

.18 Output speed monitoring signal to be selective between 4-20 mA or 0-10 V.

.15 Environmental Capabilities: The drive shall operate without mechanical or electrical damage under any combination of conditions as follows:

.1 Ambient temperature minus zero (-0) degrees to forty (40) degrees Celsius.

.2 Humidity zero (0) to ninety percent (90%) (non condensing).

.3 Vibration up to 0.5 g.

.4 Altitude zero (0) to one thousand two hundred fifty (1,250) metres.

.16 Diagnostic and indicating features:

.1 Power On indication;

.2 Percentage speed indicator;

.3 Overload indication;

.4 Short circuit indication;

.5 Ground fault indication;

.6 Overvoltage indication;

.7 Undervoltage indication;

.8 High temperature (controller);

.9 AC voltmeter (output);

.10 AC ammeter (output);

.11 Inverter ready;

.12 Inverter fault; and

.13 External fault

.17 Cooling System:

.1 Perform heat load analysis to determine air-cooling requirements.

.2 Air-cooled converters shall meet the following:

.1 Redundant cooling fans

.2 Cooling fan operates when pump is started from VFD or bypass system or when enclosure reaches hi temperature.

.3 Provide adjustable hi temperature switch, with minimum range 10°C to 30°C.

.18 Wiring:

.1 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.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 Provide wire markers at both ends of all control wires.

.5 Control wiring shall be TEW one hundred five (105) degrees Celsius rise.

.6 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.7 Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.8 The routing of all analog, digital, and power cable wiring inside VFD panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying. 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 signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent 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 panel wiring shall be 16 AWG TEW stranded conductor. Increase the size of power wiring to 12 AWG minimum.

.11 Group and form wiring into a loop when going from a fixed part of the panel to a door. Each end of the loop shall be properly supported.

.12 Ethernet Patch Cords

.1 Requirements:

.1 CAT-6.

.2 Jacket colour: Blue.

.13 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent 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.

.4 120 VAC wires cannot share wiring duct with 10 VDC, 24 VDC or 4-20 mA wires, but can cross their path.

1.12 SPARE PARTS

.1 Provide, at minimum, the following spare parts:

.1 One cooling fan

.2 All control fuses

.3 One N.O. and N.C. contact block for control switches

.4 One form “C” relay

Part 3 Execution

3.1 INSTALLATION

.1 Identify mounting requirements and include all materials and labour, including concrete pads for all floor-mounted equipment.

.2 Install VFD(s) in locations as indicated on Drawings, and connect up all necessary wiring. All VFD(s) are to be mounted in the MCC in the electrical room. Follow manufacturer's recommendations for maximum distance between the VFD and the motor. The minimum clearance in front of VFDs is one (1) metre.

.3 Connect VFD output to motor using drive rated cable.

.4 Contractor shall connect all interlocks including (but not limited to) vibration switch, freeze stats, and fire alarms to the VFD. These interlocks will be active in both the Hand (local) and Auto (remote) configurations. Ensure high vibration interlock is installed and jumpered out as indicated on the drawings.

.5 Contractor shall program all VFD parameters based on the provided settings letters to provide operation as indicated in the plans and Specifications.

.6 Contractor shall ensure that all control and stop commands shut down the drive as per manufacture's recommended procedure (example, ramp to stop, ramp and hold, or coast to stop). Contactors on the line or load side of the drive are not an approved method of control.

.7 MCC disconnect switch, VFD and motor isolation switch are to be labelled with proper shutdown procedures.

3.2 CONFIGURATION

.1 Submit settings sheet for review.

.2 Configure VFD parameters as specified on settings sheet.

.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 Confirm VFD capability to automatically re-accelerate following loss of voltage for up to five seconds.

.4 Field testing

.1 Provide on-site start-up, 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.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 – Common Work – Electrical.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Contractor shall be responsible to bring Factory representative back to reset, repair, and re-commission the VFD during the two (2) year warranty period if problems arise with the normal operation of the VFD. This includes prevention of any motor shaft voltages exceeding 1.5 V when referenced to ground.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

.5 Canadian Standards Association (CSA International)

.6 ICES-005, latest edition, Radio Frequency Lighting Devices.

.7 Underwriters' Laboratories of Canada (ULC)

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Engineer.

.3 Photometric data to include: VCP Table and spacing criterion.

Part 2 Products

2.1 LAMPS

.1 Lamps shall be as indicated on luminaire schedule on drawings.

2.2 LED DRIVER

.1 LED Driver: CSA certified, energy efficient type, IC electronic.

.1 Rating: 120 V, 60 Hz.

.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

.3 Start-up ambient temperature of -20°C for indoor luminaires, and -40°C for outdoor luminaires.

.4 Power factor: minimum 95% with 95% of rated lamp lumens.

.5 Harmonics: 10 % maximum THD.

.6 Estimated lifespan equal or greater than LED lamps of respective luminaire.

.7 Sound rated: Class A.

.8 Mounting: integral with luminaire.

2.3 LIGHTING CONTROL JUNCTION BOX (JBA-F74)

.1 Junction box shall be as indicated on drawings.

.2 Exterior lighting 0-10V dimmer control

.1 Rating: 120 V, 60 Hz.

.2 Approved Equipment:

1. Leviton IP710 or approved equivalent.

.3 Mounting:

2. JBA-F74

.3 Photocell

.1 Rating: 120 V, 60 Hz.

.2 Mounting:

1. As indicated on drawings

2.4 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.2 Install rigid PVC conduit or Teck 90 cable for luminaires.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

.2 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors (Nylon shields not acceptable) or as recommended by Anchor Construction Industrial Building Products Ltd for the specific surface & equipment being installed.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 If there is potential of Asbestos, Electrical Contractor must use a proper collection boot and HEPA vacuum whenever drilling of holes in facility.

.5 All steel channel support for wall and surface mounted luminaires to be PVC coated strut.

.6 All RGS conduit stem threaded on both sides shall be PVC coated. All hardware shall be rated for the application environment.

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

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment for Emergency Lighting.

1.2 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.

1.3 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

Part 2 Products

2.1 EQUIPMENT

.1 Battery Unit (ELB-F74)

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 VAC.

.3 Output voltage: 12 VDC.

.4 Operating time: 60 min. minimum

.5 NEMA 4X rated weatherproof, fully gasketed

.6 Liquid-tight, momentary push button test switch

.7 Signal lights: solid state, for 'AC ON' and 'Charge'.

.8 Battery: sealed, maintenance free.

.9 Charger: fully automatic, current limited charger.

.10 Battery protection: a low voltage battery protection circuit to disconnect the load when the battery reaches the end of discharge.

.11 Lamp heads: remote, fully adjustable. Lamp type: LED, 6 W.

.12 Large magnum terminal screw type connectors for remote load connection.

.13 Automatic Self Testing Feature that test once a month, every 6 months and 12 months c/w visual and audible alarm and should indicate the following at a minimum:

.1 Battery Failure

.2 Battery Disconnect

.3 Charger Failure

.4 Lamp Failure

.5 Service Alarm

.6 AC on

.7 Charger on

.14 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.

.15 Finish: Grey.

.16 Options required:

.1 Automatic test self-diagnostic

.2 Ammeter and Voltmeter

.3 Line cord & plug

.4 A.C./D.C. Terminal block capable of accepting #10 AWG Cu. Wire

.5 Audible alarm, Audible emergency

.6 Six (6) circuit fused internal distribution

.7 Internal thermostatically controlled battery heater

.8 Infrared remote test

.9 Lamp disconnect (internal)

.10 Octagon box mount (line cord delete)

.11 RFI suppressors.

.12 Time delay

.13 Twist lock plug

.2 Remote Head Lamps

.1 Supply voltage: 12 V dc

.2 CSA C22.2 No.141-15 approved

.3 Rated for wet location

.4 Polycarbonate enclosure, fully gasketed housing

.5 Fully adjustable lamps

.6 Double heads

.7 Black color

.3 Exit Lighting

.1 Supply voltage: 120 VAC.

.2 Output voltage: 12 VDC.

.3 CSA C22.2 No.141-15 approved.

.4 Green running man pictograph.

.5 Rated for wet location

.6 NEMA 4X rated Polycarbonate enclosure, fully gasketed housing.

.7 Operating time: 60 min. minimum

.8 Charger: fully automatic, current limited charger.

.9 Lamp heads: two lamps integral on unit, fully adjustable. Lamp type: LED, 6 W.

.10 Battery protection: a low voltage battery protection circuit to disconnect the load when the battery reaches the end of discharge.

.11 Signal lights: solid state, for 'AC ON' and 'Charge'.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Install exit lighting and running man pictograph.

.3 Direct heads.

3.2 WIRING OF REMOTE HEADS

.1 Conduit: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations to minimize voltage drop.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

.2 Section 40 95 13 – Control Panels

.3 Section 40 30 02– Controls Instrumentation

1.2 DESCRIPTION OF WORK INCLUDED

.1 Work of this Section consists of supply and installation of instrumentation and control equipment as specified and as shown on the plans.

.2 The work includes, but is not necessarily limited to, the following:

.1 Wiring of all process instrumentation including those devices supplied by other divisions.

.2 Training for plant operators as specified herein.

.3 Maintained service during construction and reconnection of existing CSO monitoring system to new PLC after changeover.

.4 Commissioning.

.3 This section does not include devices or equipment for installation in the control panel as specified in Section 40 95 13 – Control Panels.

1.3 SUBMITTALS

.1 The Contractor shall provide the following instrumentation plans as a minimum:

.1 Continued servicing plan for CSO monitoring system.

.2 Submit product data in accordance with Contract Document.

.3 Completed instrument record sheets.

.4 Communications system interface connection diagrams.

.5 Instrument calibration records.

.6 Instrumentation installation in process line detail plans.

Part 2 Products

2.1 GENERAL INSTRUMENT REQUIREMENTS

.1 Unless otherwise specified, the Contractor shall provide instruments in accordance with the drawings and the following general requirements:

.1 Provide indicating transmitters on nearby wall in the vicinity of the instruments. Where there are multiple instruments in proximity, group indicating transmitters.

.2 Locate in a logical arrangement. For transmitter layout, mimic physical layout of process and/or process sequence.

.3 Provide CSA 4X enclosure for all instruments.

.4 Power supply is 120 VAC unless otherwise noted.

.5 For analogue instruments, provide 4 - 20 mA, linear, isolated output, capable of driving a minimum of 600 ohms.

.6 Instrumentation cable: to manufacturer's recommendations and Code requirements.

.7 Provide all necessary brackets or stands to mount instrument.

.8 Supply any spare parts or calibration instruments required to commission instruments.

.9 Instrument tags will be generally to ISA 5.1, and supplied by instrument system supplier as required.

.10 All instruments in contact with the water shall be NSF 61 certified.

.11 Provide instruments with features and options to suit good practice in all applications.

2.2 LEVEL SWITCHES

Reference Section 40 30 02

Part 3 Execution

3.1 MATERIAL CONTROL

.1 The Contractor shall provide all components (and software where required) as outlined in this Specification and shown on the Plans.

.2 The Contractor shall co-ordinate with component and software suppliers and subcontractors to allow for timely and coordinated delivery, construction, testing,

installation and programming of the control system as outlined in this Specification.

.3 The Contractor shall identify all field instruments with a permanent, weatherproof label showing tag number and service. Use engraved lamacoid, or stamped stainless steel and fix with non-rusting screws or wire, or chain.

3.2 FABRICATION

.1 The plans have been prepared using the latest information available from the component suppliers. Check these plans against the plans supplied with the components and make any necessary changes.

.2 Obtain from the component suppliers, the manufacturer's wiring diagrams to determine the equipment terminals and record these terminal numbers on the wiring diagrams.

.3 Identify jumper settings, switch settings, program entries, etc. necessary to complete the installation.

3.3 EQUIPMENT IDENTIFICATION

.1 Refer to Section 26 05 01 – Common Work Results - Electrical.

3.4 INSTALLATION

.1 Install according to supplied instructions. Follow manufactures recommendations regarding installation locations, mounting methods, connection methods, etc.

.2 Commission all field wiring before terminating.

.3 Do not energize the control system until authorized to do so by the Contract Administrator.

.4 The Contractor shall co-ordinate the components of the instrumentation and control system to achieve a complete working system to the intent of this specification.

.5 The Contractor shall provide supports or frames if not already supplied by the manufacturer of the equipment.

.6 The Contractor shall obtain written permission from the Contract Administrator before fixing supports or frames to structural members.

.7 Mount instruments in strict accordance with manufacturer's recommendations. The Contractor shall not mount any equipment on vibrating structures (eg. handrails) or below lines carrying corrosive chemicals or where condensation may occur.

.8 The Contractor shall ensure instruments and their associated sensors are easily accessible for maintenance, calibration, withdrawal or replacement.

.9 The Contractor shall install instruments as specified in accordance with plans and as

required by process schematic.

.10 Instruments are shown on the plans in their approximate locations. Exact location shall consider visibility, work space, and any special installation instructions.

.11 Attach permanent tags.

3.5 INSTALLATION ACCEPTANCE FIELD TESTING, FINAL COMMISSIONING

.1 The Contractor shall provide the services of qualified instrument technicians to commission and demonstrate the operation of the control system. The technicians shall include commissioning of all equipment including but not limited to equipment supplied in the Contract, existing equipment, City of Winnipeg supplied equipment, and equipment supplied by others.

.2 Where specialized vendor assistance may be required, the Contractor shall ensure this is available during proposed commissioning period and pay for all costs associated with this assistance. This shall include assistance from the panel builder and system programmer.

.3 All the equipment in this Contract shall be supplied so that installation can be carried out in a reasonably expeditious manner. The Contractor shall cooperate with the Contract Administrator, the City of Winnipeg and other trades and shall provide off-site and on-site installation supervisory assistance during the course of the work as detailed herein.

.4 The Contractor shall complete instrument record sheets at the time of calibration and ensure all instruments meet specifications. The Contractor shall make record sheets available to the Contract Administrator during construction/installation period.

.5 The Contractor shall confirm correctness of operation of all instrumentation and end devices.

.6 The Contractor shall confirm correctness of operation of all instruments and end devices feeding into the control system PLC, HMI, or SCADA.

.7 Mass balance shall be demonstrated under all operating scenarios. Flow, level, and pressure values shall be in agreement.

.8 Prior to the commencement of software commissioning, the Contractor shall ensure that all deficiencies have been corrected without undo delay to the schedule of work.

.9 The Contractor shall certify the following:

.1 That the equipment has been installed in accordance with the Contract Administrator's plans and recommended installation procedures, with any discrepancies reported to the Contract Administrator.

.2 That the equipment power and grounding requirements have been satisfied, with any discrepancies reported to the Contract Administrator.

.3 That all terminations to the equipment have been properly installed, with any discrepancies reported to the Contract Administrator.

.4 Calibration and adjustment of the equipment as required to place the equipment in trouble-free operation. Certified calibration reports for each instrument shall be provided. This calibration work shall be in addition to the factory calibration provided with each device when shipped.

.5 That the system is ready for final commissioning and program testing.

.10 The Contractor shall prepare the various reports and certificates specified in this Section. One copy of each report and certificate shall be forwarded to the Contract Administrator and to the City of Winnipeg. Any discrepancies which require further action on the part of the Contract Administrator or the City of Winnipeg shall be clearly identified on the report or certificate.

.11 Prior to commencement of PLC software commissioning, the Contractor shall ensure that all spare parts, expendables and test equipment pertinent to the equipment supplied by this section and being tested, are on site.

.12 Test equipment shall include all necessary multi-meters, process instrument calibrators for 4 - 20 mA, 24 VDC devices, thermocouples signal generators. Test equipment shall be provided by the Contractor and shall remain the property of the Contractor at the end of all testing.

.13 The Contractor shall provide assistance during commissioning and start-up related to any equipment supplied by the Contractor. This shall include the manual or automatic activation of field devices.

.14 The Contractor shall demonstrate the integrity and functional operation associated with the wiring and equipment supplied by the Contractor, which is required to operate with the PLC software.

.15 Refer to Section 40 95 13 – Control Panels, for testing and commissioning to be performed under that section which may require co-operation by verification personnel under this section.

.16 The Contractor shall submit details on instrument wiring to Contract Administrator on request. Include information on raceway materials and sizes, cable and wire type and numbers, manufacturer, model, markings, ratings, listings, etc. Indicate presence or absence of grounding, bonding, screening, and drain layers in cable construction. Indicate grounding arrangements on a per cable basis.

3.6 TRAINING

.1 The Contractor shall provide one (1) day training to the City of Winnipeg's operating staff

on the operation and maintenance of the system.

.2 Training shall include for the use of both hardware, software and plant operations.

.3 Training shall be on site with the installed equipment.

3.7 Spares

.1 The Contractor shall provide the following spare parts:

.1 One (1) years supply of expendable parts, or parts requiring regular replacement.

.2 Two of each type of fuse on equipment supplied under this section.

END OF SECTION

Part 1 - General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for Control Systems.

.2 Related Sections:

.1 Section 40 05 54 - Controls: Identification.
.2 Section E6 – “Shop Drawings” of this Bid Opportunity 479-2024.
.3 City of Winnipeg Electrical Design Guide.
.4 City of Winnipeg Automation Design Guide.
.5 City of Winnipeg Identification Standard.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.4 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SYSTEM DESCRIPTION

.1 The controls shall include but not be limited to:

.1 Level transmitters
.2 Temperature transmitters
.3 Float level switches
.4 Pressure switches
.5 PLC control panel
.6 HVAC control panel
.7 Termination of control wiring to terminals within existing field termination section.

1.4 SCOPE OF CONTROL WORK

.1 Design and installation to be in accordance with the City of Winnipeg Electrical Design Guide and Identification Standard.

.2 The Contractor shall engage a factory trained representative to supervise the installation, setup, calibrate and operationally verify and commission all instruments installed on site as well as the PLC control panel and CSO monitoring panel.

.3 The Contactor shall provide a certified instrument technician in order to operate all field devices that are wired to the PLC control panel in order for City of Winnipeg staff to verify the loop is correctly wired.

.4 The Contractor shall submit written reports identifying the commissioning work, together with any parameter settings and final adjustments.

.5 The Contractor is responsible for the supply and installation of the PLC control panel, termination of field wiring for power, controls and instrumentation to the terminals within the PLC control panel. Coordinate all remote interface and alarm points with the City of Winnipeg.

1.5 SUBMITTALS

.1 Make submittals in accordance with Section E6 – “Shop Drawings” of this Bid Opportunity.

.2 Submit for review equipment list and system manufacturers 10 days after award of contract.

Part 2 - Products

.1 **NOT USED**

Part 3 - Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting: as follows:

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.2 Clean and prime exposed hangers, racks, fastenings, and other support components.

.3 Paint unfinished equipment interiors to EEMAC 2Y-1.

END OF SECTION

Part 1 - General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, the Control System Work and nameplates materials, colours and lettering sizes.

.2 Related Sections.

.1 Section 40 05 01 - Controls: General Requirements.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 Section E6 – "Shop Drawings" of this Bid Opportunity 479-2024.

.4 City of Winnipeg Electrical Design Guide.

.5 City of Winnipeg Identification Standard.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1-06, The Canadian Electrical Code, Part I (20th Edition), Safety Standard for Electrical Installations.

1.3 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.4 SUBMITTALS

.1 Submittals in accordance with Section E6 – "Shop Drawings" of this Bid Opportunity 479-2024 supplemented and modified by requirements of this Section.

.2 Submit to Contract Administrator for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 - Products

2.1 NAMEPLATES FOR PANELS

.3 Provide panel identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.4 Nameplate for each panel size 4 engraved as indicated.

.5 Nameplate for each panel mounted device size 2 engraved as indicated.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Provide field device identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for field device size 7 engraved as indicated.

.3 Nameplate shall be attached by chain.

2.3 WIRING

.1 Supply and install heat shrink labels on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each control panel.

Part 3 - Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

END OF SECTION

Part 1 - General

1.1 SUMMARY

.1 Section Includes:

.1 Instrumentation devices integral to the Control System: transmitters, sensors, controls, meters, switches, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

.2 Related Sections:

.1 Section 40 05 01 - Controls: General Requirements.

.2 Section 40 05 54 - Controls: Identification.

.3 Section 26 05 01 - Common Work Results - Electrical.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.5 Section 26 27 26 - Wiring Devices.

.6 Section E6 – "Shop Drawings" of this Bid Opportunity 479-2024.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Canadian Standards Association (CSA International).

.1 CSA-C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 40 05 01 - Controls: General Requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Section E6 – "Shop Drawings" of this Bid Opportunity 479-2024 supplemented and modified by requirements of this Section.

.2 Submit to Contract Administrator for approval samples of nameplates, identification tags and list of proposed wording.

.3 Pre-Installation Tests.

.1 Submit samples at random from equipment shipped, as requested by Contract

Administrator, for testing before installation. Replace devices not meeting specified performance and accuracy.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

Part 2 - Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: -40 - 40 degrees C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including handheld transceivers.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

2.2 ULTRASONIC LEVEL TRANSMITTERS (LIT-F100-1, LIT-F100-2)

.1 Ultrasonic Level Transmitter Requirements:

.1 Dual point level monitoring
.2 Pump on/off control
.3 Modbus communication
.4 Door mount
.5 Resolution: 0.1% of range
.6 Power requirement: 24VDC
.7 Safety Approvals: FM/CSA Class 1, Div.2 Approval
.8 4-20mA analog output

Approved Product: Siemens MultiRanger 200 HMI Dual Point

.2 Remote Ultrasonic Transducer Requirements:

.1 Remote Ultrasonic Level Meter
.2 Measuring Range: 0.45 to 15 m
.3 Beam angle: 6º
.4 Weight: 2.0kg
.5 Frequency: 44Hz
.6 Complete with submergence shield
.7 Safety Approvals: FM/CSA Class 1 Div. 2

Approved Product: Siemens Echomax XPS-15 c/w submergence shield

2.3 LEVEL FLOAT SWITCHES (LSHH-F101, LSH-F501, LSH-F102)

.1 Requirements:

.1 Suspended mechanical float switch
.2 Liquid Density Measurement Range 0.95 – 1.10 g/cm3
.3 Temperature Range: 0°C to +50°C
.4 Output: Form C dry contact
.5 Protection: IP68
.6 Approvals: CSA or cUL
.7 Materials: Polypropylene body, EPDM rubber bending relief
.8 Voltage: 250 VAC
.9 Cable Length: Confirm prior to ordering

.2 Approved Product: Flygt Model ENM-10

2.4 ELECTROMECHANICAL RELAYS

.1 Requirements:

.1 Relays as noted on drawings.
.2 Contacts: rated at 5 amps at 120 Vac.
.3 Relays to have visual status indication.

2.5 STATION OCCUPANCY SWITCH (HS-F604)

.1 Requirements:

.1 2 position toggle switch.
.2 Enclosure Rating: NEMA Type 4X
.3 Mounting: wall mounted as per drawings.

2.6 STATION MAIN WATER LOW PRESSURE SWITCH (PSL-F526)

.1 Requirements:

.1 Pressure Range: 0 to 100 PSI (adjustable).
.2 Service: Domestic Water.

.3 Enclosure Rating: NEMA Type 4X

.4 Output: Qty 1, SPDT dry contact, 10A at 125 VDC.

.5 Electrical Connection: ½" NPT (female).

.6 Process Connection: ½" NPT (female).

.7 Mounting: Pipe.

.8 Approvals: CSA and/or cUL.

.2 Acceptable Products:

.1 United Electric J6 266 1070.

.2 Or approved equal in accordance with B7.

2.7 SEAL WATER FLOW SWITCH (FSL-F011, FSL-F021, FSL-F031)

.1 Requirements:

.1 Type: Thermal

.2 Dry Contact: SPDT, rated for at least 0.2 Amps at 24VDC

.3 Power: 24 VDC

.4 Operating Temperature: 0°C to +35°C, minimum

.5 Enclosure Rating: NEMA 4 or NEMA 4X

.6 Approvals: CSA or cUL

.7 Mounting: Pipe

.8 Accessories: Provide mounting hardware as required

.9 Size: 12mm

.10 Process Connection: ANSI Class 125/150; B16.5

.11 Flow Range: 0 to 1.2 L/s (0.5 to 19 USGPM)

.2 Acceptable products:

.1 KOBOLD KAL-K

.2 Or approved equal in accordance with B7.

2.8 HVAC DUCT TEMPERATURE SENSORS (TE-F600)

.1 Requirements:

.1 Sensor: 1097 ohms @ 25°C.

.2 Insertion: 150 mm duct mount with wiring box.

.3 Mounting: Duct

.4 Operating Range: -40°C to +121°C

.2 Acceptable products:

.1 Honeywell C7031B

.2 Or approved equal in accordance with B7.

2.9 HVAC FILTER DIFFERENTIAL PRESSURE SWITCH (PDSH-F661)

.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, minimum

.4 Set Point: 125 Pa (0.5 “w.c) (adjustable)

.5 Pressure Range: As Required

.6 Enclosure Rating: NEMA 4 or NEMA 4X

.7 Approvals: CSA or cUL

.8 Mounting: Duct or Wall

.2 Acceptable products:

.1 United Electric H100K-540,

.2 Dwyer ADPS-04-1-N,

.3 Or approved equal in accordance with B7.

2.10 HVAC AIR FLOW SWITCH (FSL-F613 FSL-F652)

.1 Requirements:

.1 Type: Thermal

.2 Dry Contact: SPDT, rated for at least 0.2 Amps at 24VDC

.3 Power: 24 VDC

.4 Operating Temperature: 0°C to +35°C, minimum

.5 Enclosure Rating: NEMA 4 or NEMA 4X

.6 Approvals: CSA or cUL

.7 Mounting: Duct

.8 Accessories: Provide mounting hardware as required

.9 Size: 12mm

.10 Process Connection: ANSI Class 125/150; B16.5

.11 Flow Range: 1 to 15 m/s

.2 Acceptable products:

.1 KOBOLD KAL-F

.1 Model: KAL-8155-C

.2 Or approved equal in accordance with B7.

2.11 TEMPERATURE TRANSMITTER (TT-F010-1, TT-F010-2, TT-F020-1, TT-F020-2, TT-F030-1, TT-F030-2)

.1 Requirements:

.1 Mounting: Wall

.2 Protection: NEMA 4 or IP67 Enclosure

.3 Power Supply: Loop powered

.4 Output Signal: 4-20 mA, 2-wire

.5 Accuracy: 0.2 degrees C over range of 0 to 70 degrees C.

.6 Stability: 0.02 degrees C drift per year.

.2 Acceptable products:

.1 Siemens SITRANS TH300.

.3 Temperature Monitoring:

.1 One hundred (100) ohm platinum 4-wire RTD.

.2 NEMA 4X connection head.

.3 Terminal blocks for connection to field wiring.

.4 Provide RTD temperature sensors at the following locations:

- Pump 1 Lower Bearing Temperature **(TE-F010-2)**
- Pump 1 Upper Bearing Temperature **(TE-F010-1)**
- Pump 2 Lower Bearing Temperature **(TE-F020-2)**
- Pump 2 Upper Bearing Temperature **(TE-F020-1)**
- Pump 3 Lower Bearing Temperature **(TE-F030-2)**
- Pump 3 Upper Bearing Temperature **(TE-F030-1)**

2.12 VIBRATION TRANSMITTER (VT-F010-1, VT-F010-2, VT-F020-1, VT-F020-2, VT-F030-1, VT-F030-2)

.1 Requirements:

.1 Mounting: Equipment

.2 Protection: NEMA 4 or IP67 Enclosure

.3 Vibration monitoring to include sensors for XY directions for a total of 2 analog vibration instruments per pump and motor assembly.

.4 Power Supply: Loop powered

.5 Output Signal: 4-20 mA, 2-wire

.6 Sensor one hundred (100) mV/g

.7 Frequency range three (3) hertz to one thousand (1,000) hertz

.2 Manufacturer: IMI Sensors (PCM Piezotronics).

.3 Vibration Monitoring Locations:

.1 Pump 1 Lower Bearing Temperature **(VT-F010-2)**

.2 Pump 1 Upper Bearing Temperature **(VT-F010-1)**

.3 Pump 2 Lower Bearing Temperature **(VT-F020-2)**

.4 Pump 2 Upper Bearing Temperature **(VT-F020-1)**

.5 Pump 3 Lower Bearing Temperature **(VT-F030-2)**

.6 Pump 3 Upper Bearing Temperature **(VT-F030-1)**

.4 Vibration controllers to be provided with MCC and be precision digital PD6000-6H7 process meters. Contractor to complete wiring from transmitters to controllers located on the MCC starter sections as shown on the drawings.

2.13 TEMPERATURE SENSOR WITH INTEGRAL TRANSMITTER (TT-F681, TT-F691)

.1 Requirements:

.1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored lead wires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.2 Mounting: Wall

.3 Protection: NEMA 4 or IP67 Enclosure

.4 Power Supply: Loop powered

.5 Output Signal: 4-20 mA, 2-wire

.6 Accuracy: 0.2 degrees C over range of 0 to 70 degrees C.

.7 Stability: 0.02 degrees C drift per year.

.8 Sensor: Integral ceramic probe, 100 mm in length.

.2 Acceptable products:

.1 Siemens SITRANS TF.

2.14 AMBIENT TEMPERATURE SWITCHES – DUAL SWITCH OUTPUT (TSL-F600, TSH-F600, TSH-F604)

.1 Requirements:

.1 Functionality: Field adjustable switches, independently adjustable.

.2 Outputs: Qty 2, SPDT dry contacts. (Dual setpoints)

.3 Operating Temperature: -40°C to +40°C minimum.

.4 Sensor: Local.

.5 Mounting: Wall.

.6 Enclosure Rating: NEMA 4X.

.7 Approvals: CSA or cUL.

.2 Acceptable products:

.1 United Electric B402-120,

.2 Or approved equal in accordance with B7.

2.15 COMBUSTIBLE GAS DETECTOR & SENSOR (AIT-F611, AE-F611-1, AE-F611-2)

.1 Requirements:

.1 Functionality: Field adjustable switches, independently adjustable.

.2 Discrete Outputs:

.1 Qty 3 dry-contact, output form C relays, configurable.

.1 Relay 1 function: Gas Alarm status (set for 10% of LFL)

.2 Relay 2 function: Gas Alarm status (set for 10% of LFL)

.3 Relay 3 function: Gas Detector Fail/Trouble status

.3 Analog Outputs: Qty 2, 4-20 mA

.1 Output 1 function: Dry Well Gas Level

.4 Power Supply: 24 VDC

.5 Operating Temperature: -40°C to +60°C minimum.

.6 Local LCD display showing % LFL

.7 Sensor: Qty 1.

.8 Factory calibrated sensor, ready to perform immediately after installation

.9 Local pushbuttons or infrared remote controller to facilitate on-site configuration and calibration.

.10 Provide gas calibration kit for testing the gas sensor.

.11 Mounting: Wall.

.12 Enclosure Rating: NEMA 4X.

.13 Approvals: CSA or cUL.

.2 Acceptable products:

.1 MSA ULTIMA X5000,

.2 The supply of gas detection equipment for the City of Winnipeg has been standardized under RFP 123-2014. No alternates or substitutes will be accepted.

.3 Purchase or Quotation:

.1 All requests for purchase or quotation shall reference RFP 123-2014 to receive discount pricing that the City has negotiated with the Vendor.

.2 Contact: Darren Bye, 11061-269 St. Acheson, AB, T7X 6E1.

.3 The Bidder’s bid price shall reflect the discounted equipment price. The City will review the purchase price for standardized equipment to ensure the applicable discount factor has been applied.

2.16 COMBINED FLOW AND VELOCITY TRANSMITTER (FIT-S651/VIT-S651)

.1 Requirements:

.1 Power Supply: 24 VDC.

.2 Function and signal wiring to exactly match existing equipment.

.2 Acceptable products:

.1 GWF Q-EYE PSC

.2 Or approved equal in accordance with B7.

2.17 WIRING

.1 In accordance with Section 26 27 26 - Wiring Devices.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:

.1 Field wiring to digital device: #14 AWG Teck 90 Cu or RW90 Cu in conduit in accordance with Section 26 05 26 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Analog input and output: shielded #18 minimum stranded twisted pair ACICCu.

Part 3 - Execution

3.1 INSTALLATION

.1 Instrument components are not specifically located on drawings, but located on drawings in the general vicinity. The instrument components shall be field located as defined by mechanical piping and in accordance with the following:

.1 Instrument components shall not be attached to vibrating equipment, but shall be remotely mounted to a solid structure or on approved instrument mounting stands.

.2 Location of instruments, when shown on the drawings, is only approximate. The Contractor is responsible for actual location of field devices and must avoid interferences between conduit, pipes, equipment and instruments while providing maximum accessibility.

.3 Locate instruments components at eye level and in an easily accessible location.

.4 Instrument components that must be removed for servicing shall be installed with re-usable connectors, unions and flexible conduit.

.5 Electrical connections and terminations for field instruments and other field devices shall be in strict compliance with the manufacturer’s instructions and loop drawings. This will include wire, wire termination, labelling, rigid and flexible

conduit, fittings, and seals where required.

.2 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.3 Support field-mounted panels, transmitters and sensors on wall or pipe stands with approved mounting brackets or stands at a nominal height of 1.4 meters off floor.

.4 Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.

.5 For instruments with pre-terminated cable lengths provide a junction box as close as practical to connect with armoured cable or cable in conduit.

.6 Allow for a variation of 3 meters from locations of devices as shown on drawings without extra cost provided pertinent information is provided prior to installation. Exact location will be determined by the installation of piping and mechanical equipment.

.7 Threaded fastenings for mounting instrument components shall have either lock nuts or double nuts.

.8 Cover locally mounted instrument components, after installation, with plastic bags to protect then from dust, dirt, paint spray, insulation materials, etc. Protect from mechanical damage.

.9 Set output pressure of local air sets to pressure recommended for instrument to which it is to be connected.

.10 Independently support solenoids, regulators or similar control devices on solid, vibration free structures and not on control valves. Minimize load on pneumatic tubing.

.11 Field instruments located outdoors shall be winterized to prevent process or measurement fluids from freezing. The use of steam or electrical tracing, fill fluids, or enclosures will be shown on the Installation Detail drawings.

.12 All instrument signal wiring and 120 Vac wiring shall be run by the Contractor from the field instrument to the field device as shown on the loop drawings. This includes wiring, rigid and flexible conduit, fittings and seals where shown. Conduit penetrations are not permitted into the top of any field junction box.

.13 Electrical:

.1 Provide and route all instruments, power and control signal cabling.

.2 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Refer to electrical control schematics included as part of control design schematics on drawings. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Contract Administrator before beginning Work.

.4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.5 Install communication wiring in conduit.

.1 Provide complete conduit system to link Control panels, field panels and OWS(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.

.6 Install conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 INSTRUMENT SUPPORTS

.1 Clean and paint fabricated galvanized carbon steel mounting stands and brackets.

.2 Before a mounting stand is attached to a concrete floor the surface of the concrete to be in contact with grout shall be roughed and cleaned of all dirt, oil, grease and loose material.

3.3 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Duct installations:
- .1 Do not mount in dead air space.
- .2 Locate within sensor vibration and velocity limits.
- .3 Securely mount extended surface sensor used to sense average temperature.
- .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
- .5 Support sensor element separately from coils, filter racks.

.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 one above it. Continue until complete cross-sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

.5 Field adjust setpoint on temperature switches as per the drawings.

.6 Make adjustments as directed by the Contract Administrator.

3.4 PANELS

.1 Arrange for conduit and tubing entry from bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.5 PRESSURE SWITCHES AND TRANSMITTERS

.1 Mount in readily accessible location to allow for quick easy replacement and servicing without special tools or skills.

.2 Field adjust setpoint on pressure switches as per the drawings.

.3 Make adjustments as directed by the Contract Administrator.

3.6 CALIBRATION TAGGING

.1 When satisfactorily inspected and calibrated, the item shall have a tag affixed to it in an immediately visible location, which shall indicate that the device has been calibrated, by

whom and the date of the calibration. Calibration procedures and records shall be available to the Contract Administrator throughout the course of the project and shall be delivered to the Contract Administrator upon the completion of work.

3.7 INSPECTION AND INSTRUCTION

.1 Provide for a factory-trained representative who shall give instructions regarding the installation of the equipment.

.2 The factory-trained representative shall visit the site as required to ensure that the installation work is being performed in a proper and workmanlike manner. Allow for a minimum of one (1) full working day.

.3 The factory-trained representative shall be present to supervise the commissioning, initial operation, and functional testing of the equipment.

3.8 IDENTIFICATION

.1 All field-mounted instrument items shall have an approved identification tag permanently attached by the Contractor upon completion of the initial inspection and calibration. This tag shall reflect the device's identification as shown on the appropriate drawing.

.2 The tag will be permanently attached to the instrument with screws, rivets, or stainless steel or Monel wire, as appropriate. If an instrument is inside a protective enclosure or mounted behind a panel, instrument identity tags shall be mounted twice, once on the instrument and again on the enclosure. All instruments mounted on a control panel shall have an identity tagmounted on the instrument body and again on the face of the panel below the instrument face.

.3 Identify field devices in accordance with Section 25 05 54 - Controls: Identification.

3.9 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 40 80 11 - Automation Commissioning.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 40.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with 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.

.4 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 Bid, in accordance with B4.

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 Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Contract Document.

.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.

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

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 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.

1.8 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 Contract Administrator prior to manufacture.

.4 Allow for average of twenty-five (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 phase conductors of feeders and branch circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

1.10 SUBMITTALS

.1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.

.3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.

.4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. 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 Design Drawings and Specifications. 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.

.5 Manufacture of Products shall conform to revised Shop Drawings.

1.11 RECORD DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of Record Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. Record Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

1.12 O&M MANUAL

.1 Operations and Maintenance Manuals:

.1 Refer to Contract Document for general O&M 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 complete 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 PLC Software Operation and Maintenance Manual:

.1 To be provided by the Contract Administrator.

.3 HMI Operation and Maintenance Manual:

.1 To be provided by the Contract Administrator.

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 DEFINITIONS

.1 FAT: Factory Acceptance Test.

1.2 DESIGN REQUIREMENTS

.1 Develop a demonstration and test procedure, along with test forms, for the FAT.

1.3 SUBMITTALS

.1 Submittals in accordance with Section E6.

.2 Submit the following for review at least 15 Working 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.

1.4 CLOSEOUT SUBMITTALS

.1 Include all FAT documentation and test forms in the O&M manuals.

1.5 DEMONSTRATION AND TESTING

.1 The location of the FAT will be in a Contractor supplied facility, within Winnipeg, Manitoba, Canada.

.2 The purpose of testing is to ensure all status signals, alarm signals, controls, and interlocks defined in the Jessie Flood Pumping Station Control Narrative ("Control Narrative") within the PLC are conveyed to the City's SCADA HMI system via the cellular communication link. This shall be performed by the Contract Administrator in conjunction with the City of Winnipeg personnel. Allow up to three (3) representatives to attend and assist each FAT testing session at no additional cost.

.3 Correct deficiencies at no additional cost and re-test until satisfactory performance is obtained.

.4 Acceptance of tests during the FAT will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

1.6 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 at no additional cost 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 Advise Contract Administrator of the date of testing. Contract Administrator may, at their discretion, observe factory acceptance testing based on the completeness of the submittal or other factors.

.1 Demonstration tests to include:

.1 Complete demonstration of meeting the requirements of the applicable Functional Requirements Specification.

.2 Confirm that the light on the front of the control panel illuminates (where a light is provided).

.2 Testing of all discrete outputs by forcing the outputs in the PLC software and confirming the output is active using a pilot light or multi-meter.

.1 Confirm that the City's SCADA system is able to see the state transition.

.3 Testing of all analog inputs by using a 4-20mA or 0-10V process simulator (multi-meter with signal generating functions).

.1 Test the input at 0%, 50%, and 100% of full scale.

.2 Test the under range (0.0 - 3.9 mA) and overrange (20.1 – 24.0 mA) operation.

.3 Confirm that the City's SCADA system as able to see each of the 0%, 50%, and 100% of full scale values as they are tested.

.4 Testing of all analog outputs by forcing the outputs in the PLC software and

measuring the value with a multi-meter.

.1 Test the output at 0%, 50%, and 100% of full scale.

.2 Confirm that the City's SCADA system as able to see each of the 0%, 50%, and 100% of full scale values as they are tested.

.5 Testing of physical pushbuttons, selector switches, and pilot lights on the control panel(s).

.6 Testing of the PSTN (dial-up) modem by providing a temporary external telephone line connection to the modem and allowing for the City's SCADA system to dial out and connect to the PSTN modem for confirmation that the PLC status and alarm signals can be read.

.1 Testing of all status and alarm signals is not required. Test only a small sample of signals, including at least two discrete points and two analog points.

.7 Testing of control/interlock functions

.1 Testing of pump operation in PLC Mode.

.2 Testing pump operation in local mode when controlled by LIC-F100-1.

.3 Testing pump operation in local mode when controlled by LIC-F100-2.

.8 Testing of panel mounted local HMI.

.9 Testing of DNP3 parameters.

.10 Response times to operator actions.

.11 Controller processor spare capacity.

.12 Wireless Modem receiving and sending operation.

.13 Alarm system capabilities.

.14 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.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals in accordance with Section Contract Document.

.2 Submit commissioning plans and procedures, in writing, at least 20 Working days prior to commissioning.

1.2 CLOSEOUT SUBMITTALS

.1 Final Report:

.1 Include measurements, final settings and certified test results.

.2 Include completed commissioning forms.

.3 Bear signature of commissioning technician and supervisor.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications as set during commissioning and submit to the Contract Administrator in accordance with Contract Document.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.3 COMMISSIONING FORMS

.1 Example commissioning forms have been included as part of this Bid Opportunity. The contractor is required to develop forms utilizing the provided examples and submit draft forms to the Contract Administrator for review and approval. The Contractor shall fill out separate commissioning forms for each piece of equipment.

.2 Utilize the specifications, drawings, and Jessie Flood Pumping Station Control Narrative (“Control Narrative”) as the basis for preparation of the additional commissioning forms.

1.4 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 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.3 Correct deficiencies and re-test until satisfactory performance is obtained.

.4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.5 Perform tests as required.

1.5 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Test instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 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.

.3 Automation panels are cleaned (interior and exterior).

3.2 PROCEDURES

.1 Provide a minimum of one qualified technician to test and commission the control system.

.2 Test each I/O point from the instrument to the PLC.

.1 Verify DNP3 parameters, coordinate with City's of Winnipeg personnel to verify all DNP3 addresses are mapped properly to SCADA.

.2 Tests to be performed in conjunction with City of Winnipeg personnel to verify alarm and status signals on the City's SCADA HMI.

.3 Test both states of discrete points.

.4 Test, at minimum, two values for analog points. plus zero and full scale readings (at minimum four values total).

.5 Test each piece of equipment individually for complete functionality.

.6 Test all control and interlock functions.

.7 Test pump operation in PLC auto mode.

.8 Test pump operation in auto mode when controlled by LIC-F100-1.

.9 Test pump operation in auto mode when controlled by LIC-F100-2.

.10 Completely test the E-Stop functionality of each piece of equipment, as provided.

.11 All modifications to the software program, to bypass interlocks or sensors, shall be recorded and documented clearly in a separate document, and the software.

.1 Any software bypasses that remain, prior to leaving site, must be authorized by the Contract Administrator.

.12 All deficiencies must be corrected by the Contractor.

.13 Commission each system using procedures prescribed by the Contract Administrator.

.14 Optimize operation and performance of systems by fine-tuning control loops and PID values.

.15 Complete local HMI test.

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 changes made to the software after the FAT must be subject to re-commissioning to ensure proper system operation.

.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 Wastewater pumping station.

3.4 CHECKLISTS, FORMS, AND REPORTS

.1 Complete checklists, forms, and reports for each instrument, loop, and control device.

.1 Instrument Loop Checklist.

.2 Discrete Device 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 REFERENCES

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2021, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.2 SUBMITTALS

.1 Submit product data in accordance with contract document.

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: -40 to +55°C with 5 - 95% RH (non-condensing) unless otherwise specified.

2.2 EMERGENCY STOP PUSHBUTTONS (HSS-F010-1, HSS-F020-1, HSS-F030-1, HSS-F010-2, HSS-F020-2, HSS-F030-2, HSS-F010-3, HSS-F020-3, HSS-F030-3)

.1 Supply and install enclosed two-position maintained emergency stop operator stations for the lift pumps P-F01, P-F02, and P-F03 as indicated on the drawings.

.2 Requirements:

.1 Type: Push-Pull / Twist to release

.2 Ingress Protection: NEMA 4X

.3 Contact Life: 1,000,000 cycles

.4 Mechanical Life: 250,000 cycles

.5 Contact Rating: 10 A

.6 Contact Configuration: As shown on the drawings

.7 Illumination: Not required unless otherwise indicated.

.3 Acceptable Products:

.1 Schneider Electric Harmony 9001 K Series,

.2 Allen-Bradley 800H series,

.3 Or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.2 Readily accessible to allow for unhindered operation and servicing.

.3 Wall installation:

.1 Located as shown on the drawings.

.2 Securely mounted.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Process Control Devices including damper actuators.

1.2 REFERENCES

.1 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2021, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 NFPA 820-20: Fire Protection for Wastewater Treatment and Collection Facilities

1.3 SUBMITTALS

.1 Submittals in accordance with Contract Document.

.2 Submit commissioning plans and procedure, in writing, at least 20 Working days prior to commissioning.

.3 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

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 – 32 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Account for hysteresis, relaxation time, maximum and minimum limits in

applications of sensors and controls.

2.2 HVAC CONTROLLERS (TIC- L600)

.1 General: digital, stand alone, configurable controller

.2 Power supply: 24 VAC.

.3 Sensor Inputs:

.1 Two (2) 1097 Ohms PTC at 25°C.
.2 Sensed temperature range: -51°C to +132°C.

.4 Discrete Inputs: One (1) 18V, 3.5 mA for monitoring dry contact

.5 Mounting: panel (front of HVAC control panel)

.6 Enclosure: NEMA Type 1, minimum

.1 Honeywell T775M2030,

.2 Or approved equal in accordance with B7.

2.3 ELECTRONIC DAMPER ACTUATORS, MODULATING (FV-F601, FV-F602, FV-F603, FV-F604, FV-F605)

.1 Requirements:

.1 Direct mount proportional type.

.2 Spring return type for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Torque as indicated on the mechanical drawings.

.4 Damper actuator to drive damper from full open to full closed in less than 150 seconds.

.5 Spring return to drive damper from full open to full closed in less than 25 seconds at normal room temperature.

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Field configurable.

.8 Shaft Diameter: 8.0mm to 16.0mm (3/8” to 5/8”).

.9 Electrical Connection: 0.9 metres (3 ft), 18 AWG, plenum rated cable.

.10 Overload protection: Required.

.11 Auxiliary Switches: Not required.

.12 Power supply as indicated on the drawings

.13 Operating range: 0 - 10 or 2 - 10 VDC as indicated on the drawings.

.14 Position Feedback: Required, 0-10 VDC output.

.15 Operating Temperature: -30°C to +50°C.

.16 Housing: NEMA 2 or IP54 or better.

.17 CSA or cUL.

.18 Acceptable Manufacturer:

.1 Belimo,

.2 Johnson Controls,

.3 Or approved equal in accordance with B7.

2.4 ELECTRIC DUCT HEATER CONTROL (HCE-F66)

.1 Modulating 0-10 VDC signal from Temperature Controller TY-F661.

2.5 UNIT HEATER CONTROLLER THERMOSTATS (TS-F631, TS-F641)

.1 Temperature controlled by wall mounted thermostat provided by unit heater manufacturer.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 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.

.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.

.5 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 devices with lamacoids. Mount in a conspicuous location.

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 UNIT HEATER CONTROL

.1 Temperature controlled by wall mounted thermostat provided by unit heater manufacturer. Mount thermostat in the location shown on the drawings.

3.5 MAIN FLOOR VENTILATION CONTROL

.1 Automatic control of outdoor air, mixed air, and exhaust air dampers based on occupied/unoccupied status, temperature, and gas detection.

.1 Occupied **OR** Outdoor Temperature > 10℃ **OR** H2S gas detection > 10% LFL

.1 Duct heater HCE-F67 setpoint: 15°C (adj.).

.2 Damper FV-F601: OPEN.

.3 Damper FV-F602: CLOSED.

.4 Damper FV-F603: OPEN.

.5 HVAC fans: ON.

.6 Damper FV-F603: weighted to provide station pressure of 25 Pa relative to the outdoor air pressure.

.1 Unoccupied **AND** Outdoor Temperature < 10℃ **AND** H2S gas detection < 10% LFL

.1 Duct heater HCE-F67 setpoint: 15°C (adj.).

.2 Damper FV-F601: 50% Outdoor Air.

.3 Damper FV-F602: 50% Recirculation.

.4 Damper FV-F603: 50% Outdoor Air.

.5 HVAC fans: ON.

.6 Damper FV-F603: weighted to provide station pressure of 25 Pa relative to the outdoor air pressure.

3.6 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 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No. 205-17, Signal Equipment.

.2 International Electrotechnical Commission (IEC).

.1 IEC 61131, Programmable Controllers.

1.2 DEFINITIONS

.1 PLC: Programmable Logic Controller

1.3 PLC SYSTEM DESCRIPTION

.1 The PLC consists of a controller and an I/O expansion module, mounted in control panel CP-F81.

.2 The City utilizes a remote SCADA system that interfaces with the pumping station control system PLC via cellular and PSTN (telephone) links using DNP3 protocol.

.3 The Contractor’s responsibility on the SCADA system is limited to:

.1 Provision of an interface in the PLC for the SCADA system.

.2 Provide assistance during the testing of all status, alarm signals, and analog points between the PLC and the City’s SCADA system via the cellular network during the Factory Acceptance Test. This work will be performed by the Contract Administrator and/or in conjunction with the City of Winnipeg.

.3 Provide assistance during the testing of all status, alarms, and DNP3 points in the mapping list between the PLC and the City's SCADA system via the cellular and PSTN network during commissioning. Functional check for control/interlock functions and individual points to the city's SCADA during commissioning. Ensure that DNP3 Communications are according to city’s SCADA requirement. This work will be performed by the Contract Administrator and/or in conjunction with the City of Winnipeg.

1.4 SYSTEM ARCHITECTURE

.1 Single PLC

.1 Local I/O expansion modules.

.2 No remote I/O.

.3 A minimum of 20% spare shall be provided within the chassis for the future addition of modules. Alternatively, space can be provided within the control panel for the addition of another PLC chassis in the future.

.4 Connected to the following:

.1 MDM01 – Cellular modem (supplied by the City).

.2 MDM02 – PSTN (telephone) modem (salvage and reuse existing).

.3 Local panel mounted HMI - Schneider Electric, HMI GTO 6310.

.4 SS-F01 – Pump 1 Soft Starter (In MCC).

.5 SS-F02 – Pump 2 Soft Starter (In MCC).

.6 SS-F03 – Pump 3 Soft Starter (In MCC).

1.5 SOFTWARE OWNERSHIP

.1 All PLC and HMI programming logic will be designed and implemented by the Contract Administrator.

.2 The City shall 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.

.3 The City may turn the software over to a 3rd party, for use at any City owned facility.

.4 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.

1.6 DESIGN REQUIREMENTS

.1 Design of the complete operating PLC system will be by the Contract Administrator.

.2 The design is to be based upon the supplied Control Narrative (5-0149F-A003-00).

.1 Tag naming convention shall follow the City of Winnipeg’s standard. Tags shall not conflict with the tag scheme utilized in the Conway Lift Station Control Narrative document.

.3 The PLC is utilized to control storm-water pumping for a municipal application. The

consequences of system failure could be significant, and thus a high level of care, attention to detail, and testing is expected.

.4 The PLC software design is to be supervised and approved (sealed) by a Professional Engineer licensed to practice in Manitoba.

1.7 SUBMITTALS

.1 All submittals to be in accordance with contract documents.

.2 Stage 1:

.1 Submit product datasheets

.3 Stage 2 (provided by the Contract Administrator):

.1 Submit a PLC design criteria prior to initiating programming which includes:

.1 The general PLC program structure.

.2 The programming language (ie function block) to be utilized. Permission is required to use any other language other than FBD.

.3 A sample section of code.

.4 SCADA interface map.

.5 Variable naming methodology shall be to the City of Winnipeg's standard.

.6 HMI General Windows

.4 Stage 3 (provided by the Contract Administrator):

.1 Submit a 25% complete submittal, including:

.1 Software logic printout.

.2 HMI Windows

.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 (provided by the Contract Administrator):

.1 Submit a 99% complete submittal a minimum of 20 Working days prior to the FAT, including:

.1 Complete software logic printout.

.2 SCADA interface map.

.3 All HMI Windows.

1.8 O&M MANUALS

.1 PLC and HMI O&M information will be provided by the Contract Administrator for incorporation into the project O&M manuals.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLERS

.1 These products were standardized by the City via RFP 756-2013. No alternates or substitutes will be accepted.

.2 Part or Model numbers shall be as shown on the Control Panel drawings. Suitable product will be a PLC system produced by a major, international industrial automation vendor.

.3 Provide all required hardware for a complete installation.

.4 Modularity

.1 The construction of the PLC is to be an integrated processor, power supply, and I/O unit, utilizing additional separated I/O expansion modules that are located adjacent to the main unit on DIN rail.

.5 Self-Tests, Diagnostics and Failure Modes

.1 Integrity of controller hardware and software to be constantly monitored by an intrinsic series of continuously running self-tests and diagnostics.

.2 Immediately report abnormal results as system alarms.

.3 Have predictable failure mode upon an error. At a minimum, faults are to generate a system alarm.

.4 Equipment may have the ability to diagnose degradations to performance that may not yet adversely affect operator functions or be a permanent failure. When such conditions are automatically noted, the system is to journal the event in the Historian and have the capability to report such information selectively, as either a system alarm or a message on the programming workstation.

.6 Processor:

.1 Memory

.1 Expandable Flash: 4 GB

.2 System Memory RAM: 10 kB

.3 Program RAM: 12 MB

.4 Data RAM: 1024 kB

.2 CPU Integrated Ethernet Ports:

.1 Quantity: 3

.2 Speed: 10/100 Mbps

.3 Connection: RJ45 connector

.3 Supported protocols:

.1 HTTP

.2 BOOTP/DHCP

.3 FTP

.4 NTP

.5 SMTP

.6 SBNO

.7 QoS

.8 RSTP

.9 Modbus/TCP

.10 EtherNet/IP

.4 CPU USB Ports:

.1 Qty 1, USB Port

.2 Connector: Type Mini-B

.3 Standard: USB 2.0

.4 Speed: 480 Mbps (full speed).

.5 CPU Visual Indicators:

.1 Run LED (RUN),

.2 Error LED (ERR),

.3 Input Output (I/O) LED,

.4 Download LED (DL),

.5 Backup LED (BKP),

.6 Sec LED, (SEC)

.7 Ethernet Mod Status LED (ETH MS)

.8 Ethernet Net Status LED

.6 Acceptable Products:

.1 Qty 1, Schneider Electric BME P58 3020 CPU

.2 No alternates or substitutes will be accepted.

.7 Communications Card

.1 Integrated Ethernet Ports

.1 Quantity: 1

.2 Speed: 10/100 Mbps.

.3 Connection: RJ45 connector.

.2 Serial Ports:

.1 Quantity: 1

.2 Connection: RS-232C/RS-485

.3 Type:

.1 Qty 1, RS-485, Half duplex.

.2 Qty 1, RS-232 or RS-485 Full or Half duplex.

.3 Qty 1, RS-232, Full or Half duplex.

.4 Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400.

.5 Parity: None, Even or Odd.

.6 Word Length: 8 bits.

.7 Stop Bits: 1/2 Bit.

.3 Supported Protocols:

.1 Modbus TCP/IP

.2 Ethernet TCP/IP

.3 RTU Protocols

.1 Built-in RTU protocols for serial or Ethernet communications

.2 IEC 60870-5-101 (master or slave)

.3 IEC 60870-5-104 (client or server)

.4 DNP3 serial (master or slave)

.5 DNP3 IP (client or server)

.6 Modbus TCP (client or server)

.4 IP Protocols:

.1 NTP

.2 FTP

.3 BootP client, DHCP/FDR client

.4 SNMP agent/client

.5 SOAP/XML server

.6 NMT

.4 Acceptable Products:

.1 Schneider Electric Modicon BMX NOR 0200H,

.2 No alternates or substitutes will be accepted.

.8 Ethernet Card

.1 Integrated Ethernet Ports

.1 Quantity: 2

.2 Speed: 10/100 Mbps.

.3 Connection: RJ45 connector.

.3 Supported Protocols:

.1 Modbus TCP/IP

.2 Ethernet TCP/IP

.3 RTU Protocols

.1 Built-in RTU protocols for serial or Ethernet communications

.2 IEC 60870-5-101 (master or slave)

.3 IEC 60870-5-104 (client or server)

.4 DNP3 serial (master or slave)

.5 DNP3 IP (client or server)

.6 Modbus TCP (client or server)

.4 IP Protocols:

.1 NTP

.2 FTP

.3 BootP client, DHCP/FDR client

.4 SNMP agent/client

.5 SOAP/XML server

.6 NMT

.4 Acceptable Products:

.1 Schneider Electric Modicon BME NOC 0301,

.2 No alternates or substitutes will be accepted.

.8 PLC Rack Power Supply

.1 Redundancy: Not Required.

.2 Requirements:

.1 Supply Voltage: 10 to 30 VDC

.2 Supply Protecting: Integral fuse or breaker.

.3 Output Voltage: As required.

.4 Output Current: As required.

.5 Integrated protection against overloads, short circuits, and overvoltage.

.3 Acceptable Products:

.1 Schneider Electric Modicon BME CPS 3020,

.2 No alternates or substitutes will be accepted.

.9 PLC Inputs and Outputs:

.1 Discrete Inputs (DI):

.1 Channels: 32

.2 Type: 24 VDC Positive logic (sink) module

.3 Input Impedance: 9.6 kΩ

.4 Current sinking: Required

.5 Threshold Input Value

.1 Logic State 0: 5V, <0.5mA

.2 Logic State 1: ≥11V, >2mA

.6 Fuse Type

.1 Internal: None

.2 External: 1 fast blow 0.5A fuse for each 16-channel group

.7 Response Time: 4 ms (typical); 7 ms (maximum)

.8 Dielectric Strength:

.1 Primary/Secondary: 1500 VAC for 1 minute

.2 Between Groups: 500 VDC

.9 Indicating LEDs:

.1 Channel status (on/off) for each channel.

.10 Meet IEEE C37.90.1 surge withstand capability.

.11 Acceptable Products:

.1 Schneider Electric Modicon BMX DDI 3202K,

.2 No alternates or substitutes will be accepted.

.2 Discrete Outputs (DO):

.1 Channels: 16

.2 Type: 24 VDC positive logic static outputs

.3 Load Impedance: 48 Ω

.4 Max Current/Channel: 0.625 A

.5 Max Current/Module: 10 A

.6 Leakage Current

.1 Logic State 0: <0.5 mA

.7 Voltage Drop

.1 Logic State 1: <1.2V

.8 Fuse Type

.1 Internal: None

.2 External: 1 fast blow 6.3A fuse

.9 Response Time: 1.2 ms

.10 Dielectric Strength: 1500 VAC for 1 minute

.11 Indicating LEDs:

.1 Channel status (ON/OFF) for each channel.

.12 Acceptable Products:

.1 Schneider Electric Modicon BMX DDO 1602,

.2 No alternates or substitutes will be accepted.

.3 Analog Inputs (AI)

.1 Channels: 8 external

.2 Type: High level fast isolated inputs

.3 Input impedance:

.1 Volage Inputs: 10 M Ω

.2 Current Inputs: Internal conversion resistor (250 Ω) + Internal protection resistor

.4 Resolution:

.1 15 bit + sign

.5 Accuracy:

.1 Voltage Inputs: +/- 0.075% at 25 °C; +/- 0.1% over

temperature range.

.2 Current Inputs: +/- 0.15% at 25 °C; +/- 0.3% over temperature range.

.6 Nominal Read Cycle Time: 9ms for 8 channels.

.7 Acceptable Products:

.1 Schneider Electric Modicon BMX AMI 0810,

.2 No alternates or substitutes will be accepted.

.4 Analog Outputs (AO)

.1 Channels: 4

.2 Type: High level fast outputs

.3 Maximum load impedance:

.1 Voltage Output: 1 KΩ minimum

.2 Current Output: 500 Ω maximum

.4 Resolution: 15 bit + sign

.5 Accuracy:

.1 +/- 0.10% at 25°C.

.2 +/- 0.20% over temperature range.

.6 Response time: less than 2ms for a 0-100% step.

.7 Acceptable Products:

.1 Schneider Electric Modicon BMX AMO 0410,

.2 No alternates or substitutes will be accepted.

.10 Required Accessories:

.1 Include all accessories including cables, terminators, backplanes, memory, batteries, and other components required to make the system operable.

.11 Acceptable Products:

.1 Controller: Schneider Electric Modicon M580 PLC.

.2 I/O Cards: Schneider Electric X80

.3 No alternates or substitutes will be accepted.

2.2 PLC PROGRAMMING SOFTWARE

.1 These products were standardized by the City via RFP 756-2013 and will be provided by the Contract Administrator. No alternates or substitutes will be accepted.

.1 Utilize Schneider Electric EcoStruxure Control Expert (latest version).

.2 EcoStruxure Control Expert programming software and licenses are not included.

2.3 USB MEMORY STICK

.1 A minimum 2GB USB memory stick will be provided by the Contract Administrator 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.

Part 2 Execution

3.1 INSTALLATION

.1 Contractor is responsible for installation, wiring, testing, and assisting the contract administrator in commissioning of all PLC equipment, PLC communication equipment, PC equipment and Operator interfaces as per manufacturer instructions and recommendations.

.2 Update the processor and all updatable modules with the latest firmware.

.3 The Contractor shall supply and deliver to the contract administrator any of the computer and PLC products identified herein for the purpose of programming. The contract administrator will advise the contractor when and which items will be required on a later date. The Contractor will pay all costs associated with handling, extended warranties, etc.

.4 Contractor shall supply all required cabling to connect hardware above.

3.2 PLC PROGRAMMING SERVICES

.1 The contract administrator (MPE Engineering) will be responsible for programming of the PLC, HMI, and network equipment.

3.3 PLC COMMISSIONING SERVICES

.1 Provide all required PLC commissioning services as per Section 40 80 11.

.2 Upon completion of commissioning, Contract Administrator shall load latest software onto USB stick.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA)

.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum)

.4 Canadian Standards Association (CSA International).

.1 CSA-C22. 1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standards for Electrical Installations.

1.2 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 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.

1.3 SUBMITTALS

.1 Prior to construction:

.1 Submit product datasheets and wait for approval, prior to construction of the Control Panels.

.1 AutoCAD drawings of the control panel can be provided to the Contractor if they are required to prepare their own drawing set due to CSA requirements.

.2 Submit stamped red-line mark-ups of proposed modifications to the control

panels. If significant modifications are proposed/required, AutoCAD drawings will be supplied to the Contractor for revision.

.2 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 Do not ship control panel until approval from Contract Administrator is received.

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 presence of the Contract Administrator.

Part 2 Products

2.1 GENERAL

.1 Construction of the control panels is required, in accordance with the supplied drawings.

.2 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.

.2 All indoor control panels shall be NEMA 12 or as shown on drawings.

.3 All enclosure angles and cut-outs shall be free of dents, gouges or weld marks, and shall present a clean, smooth appearance.

.4 No screws, fittings or other fastenings shall be used on external panel faces, which must be free of any marks, scratches or defaults.

.5 The door is to be a minimum fourteen (14) gauge steel plate, full height and flush with

adjacent surfaces.

.6 The exterior of the control panel shall be painted ANSI 61 grey.

.7 The interior of the control panel shall be painted gloss white.

.8 All control panel doors shall be 900 mm (36 inches) wide maximum.

.9 All control panel doors shall open through 180 degrees without restriction.

.10 All control panels of a depth greater than or equal to twelve (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.

.11 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.

.12 Enclosure shall be Hoffman A726010ULPG or equivalent.

2.3 POWER SOURCE

.1 Each power source must be protected by a CSA approved circuit breaker.

.2 The location of each power source must be clearly shown.

.3 Panels powered by more than 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 City, 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.

.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 supplier must supply and install such components when required.

.4 Ground Bus Bar:

.1 Supply a ground bus bar in each control panel as indicated on the drawings.

.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.

.4 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 equivalent.

.5 Programmable Logic Controllers:

.1 As per section 40 94 43.

.6 Touch-screen HMI

.1 As per section 40 94 43.

.7 Wireless Modem:

.1 As per Contract Document.

.8 General Purpose Relays:

.1 Type: DPDT or as shown on drawings.

.2 Indication: LED.

.3 Diode: Provide

.4 Coil Voltage: As per drawings.

.5 Contact Rating: 5A (120 VAC), 5A (24 VDC).

.6 Approvals: CSA.

.7 Manufacturer: Omron or approved equal.

.9 24 VDC Power Supplies:

.1 Input: 100 - 240 VAC

.2 Output: 24 VDC, 10 A (adjustable 22.5-29.5 VDC)

.3 Battery: 12 Ah

.4 Monitoring outputs: 24 VDC, Alarm, Battery Mode, Battery Charge

.5 Manufacturer: Phoenix Contact

.6 Model: QUINT-UPS/24DC/24DC/10 (2320225) with QUINT-BAT/PB/24DC/12AH (1274119) or approved equal in accordance with B7.

.10 Level Transmitters (LIT-L100-1, LIT-L100-2)

.1 Display digital reading of process value and provide control of output relays based on input.

.2 Mounting: panel mount.

.3 As per section 40 30 02.

.11 Cellular Modem:

.1 Supplied by City.

.12 PSTN Modem:

.1 Salvage and re-use existing PSTN modem in new panel.

.13 Ethernet Switch:

.1 4-Port Industrial Ethernet Switch

.2 Manufacturer and model:

.1 Phoenix Contact 1085039

.2 Or approved equal in accordance with B7.

.14 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.

.3 Where ground bars are installed on to the rear or side wall of the enclosure, seal screw penetrations to maintain enclosure rating.

.15 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 from.

.5 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels.

.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 non-erasable markers.

.7 The routing of all analog, digital, and power cable wiring inside control panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying. 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.

.8 All analog signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent. 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.

.9 All 24 VDC or 120 VAC discrete signal panel wiring shall be 16 AWG TEW stranded conductor.

.1 Increase the size of power wiring, 12 AWG minimum.

.10 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.11 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door. Each end of the loop shall be properly supported.

.12 Ethernet Patch Cords

.1 Requirements:

.1 Cat-6A.

.2 Jacket colour: Blue.

.13 Wiring Duct:

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent.

.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.

.4 120 VAC wires cannot share wiring duct with 10 VDC, 24 VDC or 4-20mA wires, but can cross their path.

.5 All DC, AC, and thermocouple wiring shall be routed in separate wireways to prevent signal interference.

.14 Wire ties shall be non-metallic.

.15 Wiring shall be arranged to be readily accessible for inspection and maintenance.

.16 The wiring arrangement shall not interfere with access to panel mounted devices or spaces for future equipment.

.16 Overcurrent Protection

.1 Panel-mounted devices and all control circuits shall be protected by appropriately sized fuses or circuit breakers.

.17 Internal Lighting

.1 Difficulties resulting from electrical noise generated by fluorescent lamps shall be corrected.

.18 Cooling and Heating Systems

.1 Control panels shall be designed for the environmental conditions of the installation location. Cooling and heating systems shall be in accordance with the specific NEMA rating required by NEMA ICS 6 and NEMA 250.

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.

.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 lamacoid material with a white background and engraved black letters for internal and external components. Nameplates must resist harsh industrial conditions.

.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.

3.3 TESTING

.1 Send invitation to the City with 5 days advanced notice and submit with it agenda with list of all tests and procedures. If the City declines the invitation then submit test results for their review and approval prior to shipment.

.2 Testing of the control panels shall be fully completed 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 control panel manufacturer 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 E-stop system component functionality.

.7 Receptacle and lighting functionality.

.8 Modem and Ethernet switch functionality.

.6 If the panel is modified after tests have been performed, tests shall be repeated at no additional cost.

3.4 SHIPMENT

.1 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.

.2 Shipment of any panel having shortages of equipment shall be approved in writing by the City.

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 SUBMITTALS

.1 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to the Contract Administrator, 30 working days prior to anticipated date of beginning of training.

.1 List name of trainers, and type of visual and audio aids to be used.

1.2 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with all aspects of the instrumentation system installed in the facility.

.2 Contract Administrator reserves right to approve instructors.

1.3 INSTRUCTION

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of the system installed.

1.4 TRAINING

.1 See Section E13 of this Bid Opportunity.

.2 Provide equipment, visual and audio aids, and materials for training.

1.5 MONITORING OF TRAINING

.1 Contract Administrator to monitor training program and may modify 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.

END OF SECTION

Part 1 General

1.1 MAINTENANCE SERVICES

.1 Not required.

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 any critical system supplied by the Vendor.

.2 Critical systems include, but are not limited to:

.1 Communication networks.

.2 PLC system.

.3 Instrumentation.

.3 Perform work continuously until system is restored to a reliable operating condition.

.2 Response Time:

.1 The response time to emergency service calls is to be less than four hours.

.3 Record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.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 covered under manufacturer's warranty, the Contractor will be paid for the service call.

.3 If the issue is determined to be due to an issue outside of the Contractor's responsibility, the Contractor will be paid for the service call.

.4 Payment will be based upon the rates specified in Form B.

.5 If the service call is subsequent to Total Performance, submit an invoice, based upon the established rates to 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